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The Bicheroux Process of Making Plate Glass

Until a few years ago the underlying principle of plate glass manufacture had remained unchanged from the time when plate glass was first made in France at the Saint Gobain glass works by Abraham Thévart in the year 1688. The process was protected by letters of patent, issued under the signature of the "Great Monarch," Louis XIV.[1] Although considerable improvement has been made, especially in the grinding and polishing processes since the introduction of electric power in plate glass manufacturing, the basic principle of the process had not undergone any modifications until the advent of the Ford continuous process, the Libbey-Owens plate glass process and the method developed by the Pittsburgh Plate Glass Company.

In the casting process, the content of a pot is poured out on a casting table, to which is attached a heavy iron roller,

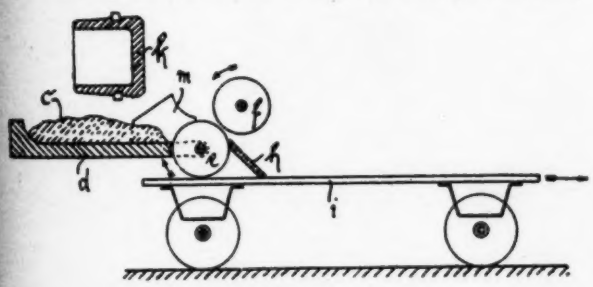


FIG. 1

having a length equal to the full width of the table. The sides of the table are fitted with strips which permit the production of glass of different thickness. As the glass is poured onto the table from the pot, the roller passes over the viscous mass and rolls it out into a sheet of uniform thickness. The plate is then transferred to the annealing oven and is subsequently ground and polished.

This method has certain inherent disadvantages. During the rolling of the glass there is considerable cooling, due to loss of heat caused by the intimate contact of the glass with the bottom of the casting table and the heavy metal roller. This results in the formation of coldcracks of the surface skin, which covers glass in a more liquid condition located in the center layers of the sheet. The pressure exerted by the roller results in considerable uneveness of the surface, which must be removed by the grinding and polishing process. It has been found that sheets of less than 10 millimeters in thickness cannot be made profitably in this manner. For this reason plate glass of, say 6 millimeters in

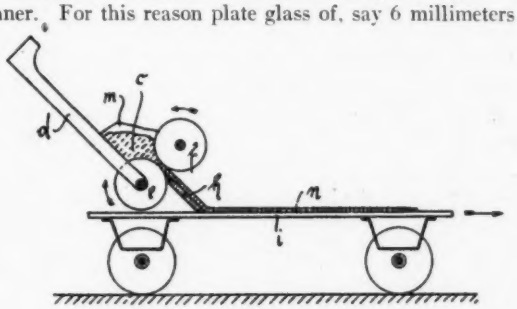


FIG. 2

thickness, is more expensive than heavier plate, since thinner plate requires more grinding and polishing of the surface.

The object of the Bicheroux process is to eliminate the deficiencies of the glass surface, so that less grinding is required to obtain a perfectly smooth finish, and to produce a thinner sheet at the outset. The advantages thus gained result in a larger output of plate glass per pot, as there is less loss of glass, removed by grinding. It is claimed that the Bicheroux process is the most economical method of producing plate glass of moderate sizes, such as are demanded by commerce, and that the cost of production is lower than any other process in use at the present time.

The principle of the Bicheroux process is as follows: The content of a pot is poured onto a casting table (d), Fig. 1, which can be raised slowly to the position shown in Fig. 2. This causes the molten glass to flow between two rollers, (e) and (f) moving in opposite directions, as indicated by arrows. These rollers continually draw molten glass from the center of the mass of glass resting on the casting table, which therefore is in the best condition to be rolled out. This is in contrast with the old method, in which the coldest glass receives the greatest pressure.

The sheet formed between the rollers moves downward

[1] Lucas de Nehou is frequently mentioned as the inventor of the casting process of making plate glass. An interesting discussion of the history of this invention occurs in Bontemps' "Guide du Verrier," Book III, pp. 428-434.

over the inclined surface (h) and is received by the transportation table (i) which moves along with the sheet as it emerges from the rollers at the same rate of speed. When the full length of the transportation table has been covered, another table moves forward to receive the flowing sheet of glass. In turn it is replaced by a third one. At that time the sheet has cooled sufficiently to allow cutting it up in the desired lengths. To effect this, a double cutting edge (r) Fig. 3, is drawn across the surface of the sheet of glass, while at the same time it follows the movement of the sheet

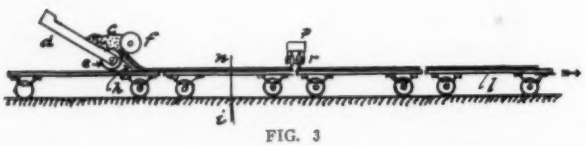


FIG. 3

along with the transportation table, so as to produce a cut at right angles. This removes a narrow ribbon of glass, which drops between the two transportation tables. The severed sheet can then be transported to the lehr.

The problem of taking care of the content of a large pot of glass has been solved in the following manner. The casting table (d) has at the end nearest to the rollers, two wedge-shaped ridges, (m) Fig. 4, which divide the glass in three separate bands, having a width which may be varied according to circumstances. These separate bands are taken up by separate, shorter sets of rollers e_1 and f_1, e_2 and f_2, e_3 and f_3, as shown.

When, after pouring the molten glass from the pot on the casting table (d), the latter is moved to the inclined position, the rollers also move, so that the dividing wedges (m) always remain in their proper position with reference to the rollers, resulting in the division of the glass sheet in separate, parallel moving bands.

Tests made in actual practice have proved that the surface defects mentioned above disappear entirely if the surfaces of the glass plate are fluted. The flutes may be produced by using fluted rolls. This method is of particular advantage in the manufacture of large glass plates produced on glass rolling machines in one turn from the whole contents of a large melting pot. In the manufacture of such large sized glass plates, the glass mass possesses already during the rolling operation a relatively great stiffness, so that no danger exists of the glass clinging in the flutes of the rolls. The effect of the flutes is as follows: Owing to the viscous nature of the glass mass it does not fill the flutes to their full depth, but fills only the outer portions of the flutes, so that air remains in the latter and forms an insulating layer which considerably reduces the surface of contact between the glass and the rolls. The result thereof is that on the one hand the danger of quenching and the consequent formation of imperfections on the surface of the glass plate is reduced. In order to accomplish the purpose, it is sufficient for the flutes to have a depth of only some tenths of a millimeter. The flutes make the surface of the glass plate smoother in the sense that, although a defect of some few tenths of a millimeter is intentionally inflicted upon the plate, defects of about 1 to 1½ millimeters, mostly entailed in the old method of making plate glass, are avoided. On the other hand, the parts of the glass mass which have entered the flutes solidify at once and form a frame by which the glass surface is stayed and protected against subsequent deformation. Another advantage of the ribs or flutes on the surfaces of the glass plates resides in the fact that in carrying the glass by means of conveying tables to the annealing kiln, the ribs offer only a small surface of contact to the tables so that the transmission of heat from the glass to the tables is reduced. This advantage may even be increased by providing the surface of the conveying tables also with suitable flutes, which preferably extend transversely or obliquely to the flutes of the glass plates in such a manner that a contact between the glass and the table takes place only at the points of intersection of the respective ribs, whereby a further reduction of the heat transmission is attained so that the glass can be brought into the annealing kiln at a higher temperature than has hitherto been possible.

In rolling out the glass mass on the rolling machine, the rolls produce plates which are fluted on both sides. Upon leaving the rolling machine the plates are deposited on tables which are advanced in accordance with the progress of the rolling operation and then moved forward until they reach

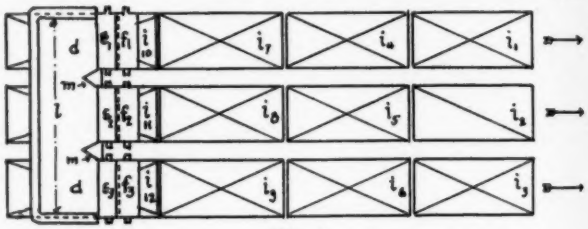


FIG. 4

the opening of the annealing lehr. From this point, the glass plates are shifted into the lehr.

The advantages of the process are claimed to be the following:

1. Clearness of the glass produced.
2. Avoidance of coldcracks.
3. Smooth surface of the glass.
4. Possibility of producing glass of various sizes, according to demand.
5. Possibility of producing glass of various thicknesses, according to demand.
6. Low cost of production.

Since cost of production is closely related to the amount of molten glass that can be worked up at one time, the cost can be reduced by using larger pots. It is possible to make glass of various degrees of thickness and of varying dimensions from the same pot, by adjusting the spacing of wedges (m), by varying the distance between the rollers, and by cutting the sheets to different lengths. In this way great flexibility of production is assured, without impairing the continuity of the process.

A detailed and authoritative description of the Bicheroux process in commercial operation at the Herzogenrather Glaswerke, Bicheroux & Cie, Herzogenrath, Germany, has been written by an eminent German authority on glass making machinery and will be published in an early issue.—EDITOR.

A Successful Pennsylvania Milk Bottle Plant

Factory of the Atlantic Bottle Company at Brackenridge

By Irving E. Adams*

One of the progressive glass plants among those devoted to the manufacture of milk bottles is that of the Atlantic Bottle Company at Breckenridge, Pennsylvania. This particular plant being a notable factor in the milk bottle industry, some data relating to it may be found interesting.

Any plant devoted to the manufacture of a single article over a period of years and having evolved from an older plant with a long history devoted to the manufacture of the same product, is bound to develop operating technique of a high order.

To those who may have been acquainted with the old Fidelity Glass Company of former years, a visit to Breckenridge today would bring back no memories, for the fine modern plant which has grown since the Atlantic Bottle Company took hold in 1916, and shown in Fig. 1, is entirely new and bears no resemblance to its predecessor.

As shown in this view of the plant, there are today two large modern melting units, with a combined potential annual productive capacity of 310,000 gross of milk bottles, or expressed differently, from eight to ten carloads a day.

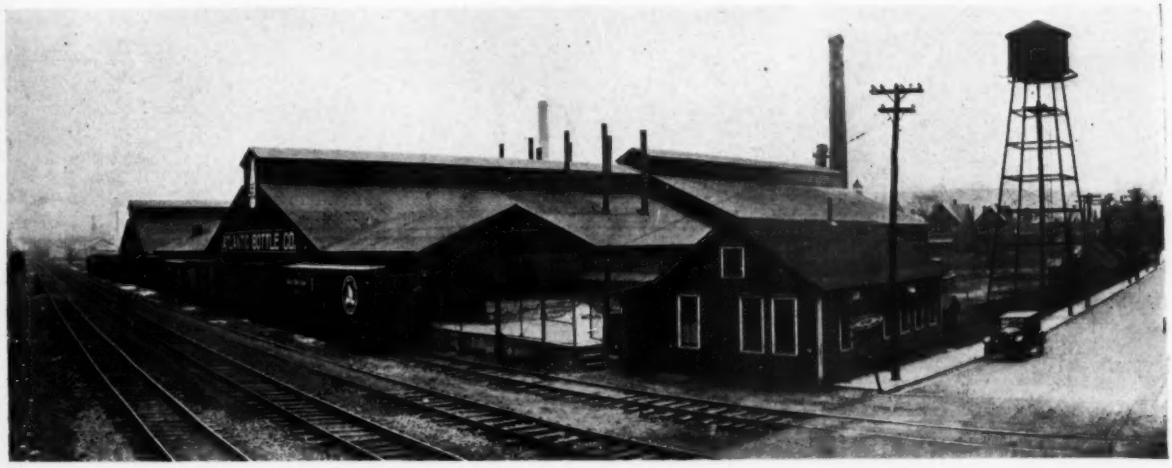


FIG. 1. GENERAL VIEW OF THE BRACKENRIDGE, PENNSYLVANIA, PLANT OF ATLANTIC BOTTLE COMPANY
A large concrete and steel storage warehouse extends under the buildings, below ground level

FIG. 2. THE MOLD AND MACHINE SHOP

FIG. 3. HOT END OF MELTING TANK

There is a total storage capacity of about 12,000 gross of crated bottles. This means again about 33,000 square feet of storage space. This hardly seems possible, for no warehouses are seen in the picture. The answer is that the buildings have, in effect, another floor below the ground, built of

* Consultant on Glass Problems, Pittsburgh, Pa.

steel and concrete and dry and light, with thirteen-foot headings. Another index of the size of the plant may be gained from the statement that twelve carloads of material can be loaded in and out, at the same time.

The open space at the extreme left of the general view contains sufficient ground, owned by the company, to permit expansion in the same linear direction to a five unit plant.

A photograph taken a year from today, will probably show, between the two present units, a very modern batch mixing and cullet grinding installation, while such a view in the very near future would undoubtedly indicate a producer gas unit.

The mold shop, as shown in Fig. 2, is of modern construction, well lighted, and adequately equipped to take care of the making of all molds used, and with sufficient accessory machinery for machine upkeep and general repair work.

Fig. 3 illustrates the hot end of one of the large tanks. It shows details of filling-in, the style of port construction, the air-cooling system, and the lower portion of the large overhead hopper. The tank is 22 feet by 41 feet by 42 inches and was designed and built by the H. L. Dixon Company. It has proven very efficient and readily handles a daily load of 80 tons. This is some five tons over the estimated capacity of the tank, but it is possible to keep the glass plained up and of requisite strength even at this pull. The port design is apparently the main factor involved, particularly when the fuel used is natural gas as in this case. The other tank is of similar dimensions and was designed by the Russell Engineering Company of St. Louis, Mo.

Each of the melting tanks, Fig. 4, is equipped with six Miller feeders working in conjunction with the Miller P. C. Geneva model, electric-driven, eight mold, eight blank machine. Bottles from the machines are conveyed to the lehrs by equipment from the Automatic Machinery Company. On one tank are four lehrs of the Simplex type, and on the other, four of the H. L. Dixon design. All lehrs are 10 feet by 60 feet in size. Natural gas is the fuel used.

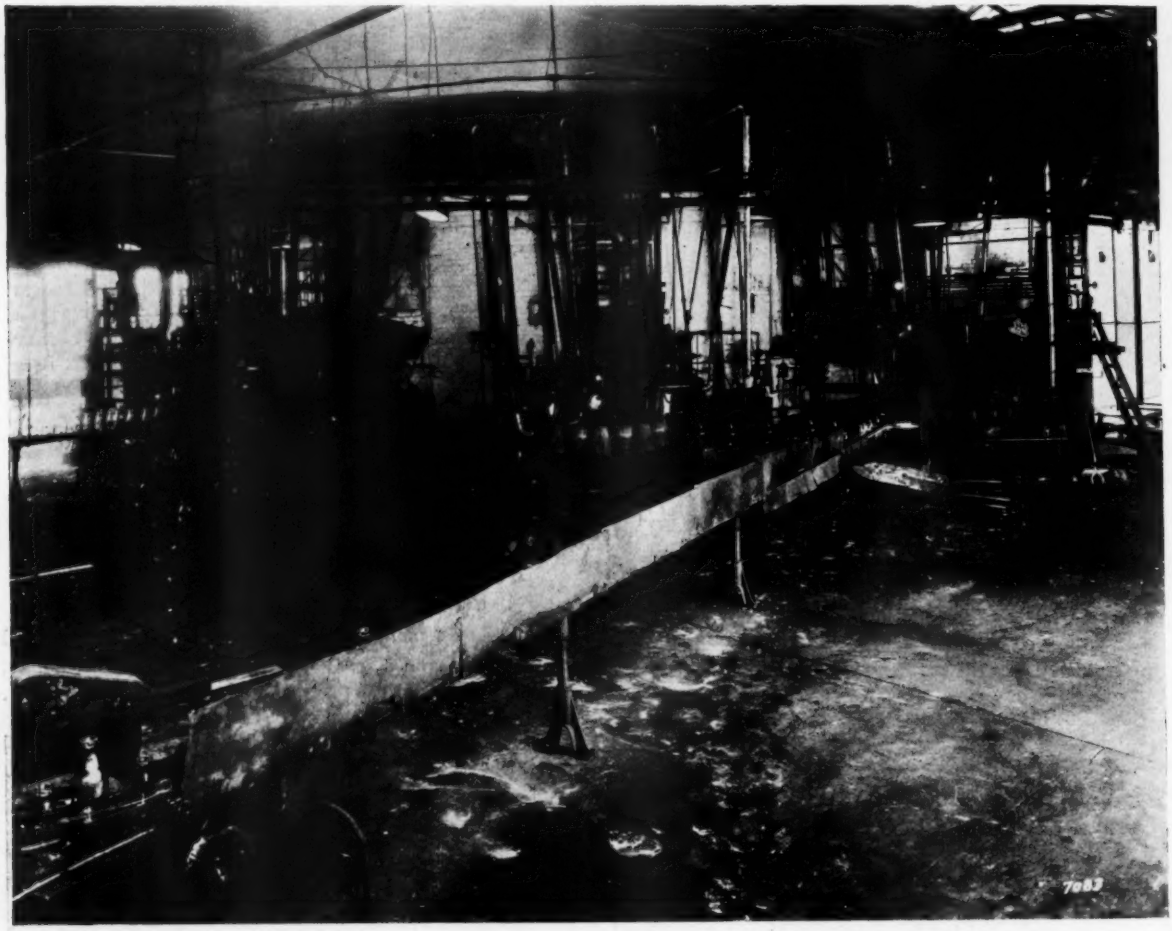


FIG. 4. AN INGENIOUS DEVICE PERMITS THE LOADING OF BOTTLES FROM TWO MACHINES ONTO THE CONVEYOR, WITHOUT INTERFERENCE

The refining ends of the large tanks are partly insulated with cork brick. Water cooling is installed in air space at bridge and at throat.

The feeders and machines, the cooling system, the lehr conveyors, and the bottles entering the lehrs are shown in Fig. 4.

Compressed air for the machines is provided by two Ingersoll-Rand compressors, each of 1,800 cubic feet of air per minute capacity, and operated by synchronous motors. Sim-

ilarly, air for cooling purposes is obtained from two 75 horsepower extra heavy plate Sturtevant fans, direct connected. Power is purchased from the Pennsylvania Salt Manufacturing Company nearby. General Electric fans operate all machinery.

Fig. 5 shows the cold end of the lehrs, the tables on which the preliminary sorting of the different types of bottles is made, and the actual final inspection and method of crating. It is interesting to note the Cooper-Hewitt lamps and the general well lighted condition that obtains in the sorting room. The cost of these lights is slightly higher than that of an ordinary lighting system but they are worth the increase.

Fig. 6 gives a general idea of the loading method used.

As might be expected the entire plant is under adequate temperature control, each furnace and each battery of lehrs being equipped with a Wilson-Maeulen pyrometer. The bottles are tested regularly for annealing, chord, and actual breaking strength.

Burnt lime only is used in the batch at this plant and feldspar at the rate of 130 pounds to the ton of batch.

The main office of the Atlantic Bottle Company is at 90 West Broadway, New York. E. F. Glacken is president of the company and responsible for its development. H. C. Ganter is plant manager at Brackenridge.

FIG. 5. COLD ENDS OF LEHRS, SORTING AND INSPECTION

FIG. 6. LOADING CARS FROM STOCK

The Deterioration and Failure of Refractories

By B. M. Pearson

(Concluded from the August number)

Cracking of Glass Pots

Chemical corrosion is not the only agent in determining the useful working life of a pot. Glass pots are very sensitive to any sudden changes in temperature, and crack with extreme readiness from this cause. Thus if from any cause, the positive pressure inside the furnace, which should be present if the furnace is being worked under correct conditions, fails, and a negative pressure is maintained instead, cold air will be sucked in, and if such cold draughts happen to come into contact with the pots, these will surely crack. Again, even if a positive pressure is maintained inside the furnace, and there are cracks or crevices in the mantle wall, through which cold draughts can enter, they will do so, as the positive pressure venting at the top will tend to create something in the nature of a partial vacuum below, which will tend to draw in cold air through such crevices. It is particularly dangerous to have such cold draughts near the bottom of the pot, as this is the most sensitive part of the pot to temperature changes and the part very easily cracked. Once a crack is formed the pot may be given up as actually ruined. In the case of an open pot a good deal can be done by opening the side wall and patting stiff clay into the crack. If the crack is at the back the pot can be spun round on the siege, until it is round at the front when it can be attended to. In the case of a crack in the bottom the pot may be levered up, and clay placed on the siege under the cracked portion. If the pot is allowed to subside on the clay, the crack will be more or less stopped up. In the case of a covered pot, the crack, if at the front, can be stopped up in the same way, but if at the back, the pot is absolutely lost. Anyhow, such patching is not very satisfactory, and will only give a few more weeks of pot life, once the cracking has commenced. In a very short while after a crack has appeared, even if it is only a very narrow one, it rapidly widens to very large proportions, of the order of an inch or so in width. If a pot is not brought up satisfactorily in the pot arch, small cracks may be formed, particularly in the early stages of the firing curve, which may not be apparent even when the pot is at working heat and set in the furnace. The cracks will then, apparently inexplicably, make their

appearance known in the pot, after a week or so of working.

Dr. Travers[4] demonstrated the long life which can be obtained from glass pots, providing that they are given the correct preliminary heat treatment before being exposed to working conditions. A pot which had been got up in the arch to 1000 deg. C., transferred to the furnace, glazed and filled without delay remained in the furnace, which was of the ordinary round direct-fired type, for five months, and when removed the whole of the inside was found to be badly corroded. A second pot was heated in the furnace for twenty-four hours before filling. The sides of the pot were completely vitrified and were not attacked, but the bottom which had not become vitrified was badly corroded. The first pot had apparently been subjected to a temperature insufficient completely to vitrify the pot material, but sufficiently high to allow of the glass corroding it badly. In a third case, a pot after setting had been heated for a sufficient time for complete vitrification of the whole of it. The pot remained for 146 days in a very hot arch of the furnace, yet no part of it showed any sign of corrosion.

Discussing generally the subject of pot failure, S. N. Jenkinson[5] deals with and discusses the causes of the following faults.

1. Pitting or Honeycombing.
2. External Cracking.
3. Batch Cracks (Internal).
4. Holing.
5. Excessive Solubility of Bottoms.

According to Jenkinson, pitting can be avoided by employing a rather highly aluminous clay, and a fairly high furnace temperature.

He thinks that external cracks, which have been observed to be present in a direct-fired furnace, but not in the gas fired furnace are caused by sudden changes of temperature.

Dealing with batch cracks he considers that these have been originally caused by the introduction of cold batch and cullet into the hot pot, suddenly chilling the surface, causing the formation of small fissures, which are subsequently enlarged by the solvent action of the glass.

He ascribes failure by shot-holing to be caused by the presence of pieces of pyrites in the clay. This failure can be prevented by weathering the clay sufficiently well, and by employing fine grinding in preparing the clay material.

Excessive solubility of the bottom, which is usually the weakest part of a glass pot can be combated by vitrifying this part, which can only be done really satisfactorily by employing a sufficiently high firing temperature in the pot arch, say 1300 deg. C.

Other Refractories for the Glass House

The refractories used for pot arches have not a very exacting program to fulfill. They are required to be of moderate refractoriness, and second grade fire bricks are suitable for the purpose. They will be required to withstand a temperature of about 1300 deg. C.

Fire bricks used for gas producers are used under what may be termed severe conditions. Thus very high temperatures are reached in the fire or oxidizing zone of a gas producer, and apart from this, the ash will fuse onto the brickwork, forming a bridge of clinker. When the producer is clinkered, this may have to be removed with crowbars, under bad conditions, taking large pieces of the firebrick lining with it. Care should be taken to use a coal having as refractory an ash as possible, to avoid any undue clinkering. At the same time the firebrick used should be highly refractory and as resistant to chemical corrosion by the ash slag as possible. Where a coal with a low temperature fusing ash has to be employed, plenty of steam should be used in the air blast, to reduce the temperature of the fire zone, and to soften the clinker. The bricks used in the lining have not only to resist the fluxing tendency of the ash, but there is also a very distinct wear, from the abrasive action of the passage of the fuel through the producer. The movement will rub on the firebrick lining and will wear it away in the process. It is found that a fine textured brick is the most satisfactory to use for the gas producer lining, as one which will answer and stand up to the special conditions of use the most satisfactorily.

For the construction of the upper parts of glass tank furnaces, medium textured highly refractory firebricks are generally found to give the best results under usage. Very high temperatures are required to be withstood for one thing. The brick should also be carefully chosen with a view to its resistance to chemical corrosion, as it has to withstand also the fluxing effect of the alkaline vapors present in the tank furnace atmosphere, just the same as do the bricks forming the crown. For building the necks of regenerators and recuperators, still more severe conditions are met with. Very high temperatures are met with, up to 1600 deg. C., also there is a severe chemical corrosion taking place, due to the soda ash alkaline dust carried mechanically by the furnace gases, and also a wearing away by abrasion, on account of the gritty dust carried from the producer, through the furnace, by the gases. Taking all things into consideration, a fairly coarse textured, high refractory brick will give the best results for such a position, when exposed to this combination of conditions.

For the construction of regenerator checkers, a brick is required which is fairly insensitive to sudden changes in temperature, as occurs during the reversal of the flow of gases in the furnace. There is also a very pronounced action occurring from the action of the alkaline dust carried into the regenerators by the waste gases, and the abrasive action of the dust carried in suspension by the furnace gases.

Insley[6] has studied the surface deposits formed in glass furnace regenerators, on the face of the refractories. It was found by Booze and Flint that bricks with the highest alumina content were the most resistant to the action of slags. The temperature of the regenerator in the upper part of which the bricks were set, varied from 1100 deg. C.-1200 deg. C., in the case of regenerator No. 1, and in the case of regenerator No. 2 from 985 deg. to 1100 deg. C. The furnace dusts acting on the brick in regenerator No. 1 were high in silica, alumina, alkalis and lime, and the dusts in regenerator No. 2 high in alkalis, lime and magnesia, and low in silica and alumina. From regenerator No. 1 the surface of the brick was covered with a brown

[4] *Jour. Soc. Glass Tech.*, Dec., 1918.
[5] *Jour. Soc. Glass Tech.*, May, 1918.
[6] *J. Am. Cer. Soc.*

and white deposit. The composition of the original brick was stated to be 34.7 per cent SiO_2 and 58.6 per cent Al_2O_3. The interior of the brick as taken from the regenerator was composed of needles of mullite, crystals of corundum, and a small amount of glass. The crystals of corundum were probably formed by the crystallization of dehydrated diaspore. The white vitreous border zone between the interior of the brick and the surface deposit contained large well developed mullite crystals, a small amount of glass, and a very few corundum crystals. The formation of corundum here is due to the dissociation of mullite which when pure takes place at 1810 deg. C., but when fluxes are present very probably occurs at considerably lower temperatures. In the outer deposit the most abundant constituent was nephelite ($Na_2O\ Al_2O_3\ 2SiO_2$).

The same type of brick after use in No. 2 regenerator was different in appearance, because the surface deposit was present as a thin brown skin, less than 0.5 mm. in thickness. The interior of the brick was the same, except for a lesser development of mullite crystals, probably due to lower temperature. The thin outer crust was composed principally of nephelite and carnegieite (the high temperature form of nephelite).

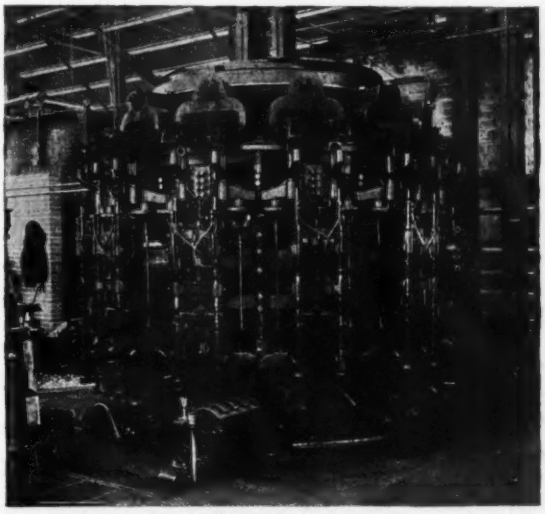
It must be remembered, of course, that in considering the chemical attack on regenerator refractories, that unlike the upper parts of the melting part of a glass furnace, the temperature is comparatively low. Consequently, a large portion of the alkali volatilized in the furnace will condense on the regenerator bricks. Again, there is the alkali dust carried over mechanically. The melting point of nephelite for instance is about 1525 deg. C., and so the silicate formed by the alkali attack will be very viscous, and will tend to build up a protective layer on the surface of the bricks. The same set of conditions rules to some extent in the cooler working ends of some glass furnaces. In the melting areas on the other hand, the temperature is sufficiently high to allow the silicate formed to flow away and leave a fresh surface exposed for attack.

The History of the Incandescent Lamp

THE invention of the incandescent lamp by Edison and his co-workers has literally added billions to the wealth of the world. Modern life would be difficult to imagine without electric illumination. It is another one of the many conveniences which we take for granted, and usually dismiss from our minds, without further thought. An interesting book entitled "History of the Incandescent Lamp," by John W. Howell* and Henry Schroeder*, of the General Electric Company, gives an account of the development of the different branches of industry which have cooperated to produce the present day, highly efficient incandescent lamp. The book describes the development of electric lighting, of the electric light and power industry, the groping of inventors—many of great ability—to produce a practical incandescent lamp. The enormous amount of research work which had to be done before Edison's invention became a success calls for admiration. One of the main features of the incandescent lamp, of course, is the glass. The glass industry has had its share in the struggle to produce the victory of which the world is enjoying the fruits today. The following description of glass construction forms one of the most fascinating chapters of the glass industry.

Glass Construction

When Edison began experimenting on electric lamps he, like all other experimenters, made the glass chamber in two parts which were separably fitted together. This enabled him to renew a filament easily. Later when he realized that he must use a thin high resistance filament, he also realized that the very high vacuum, which was necessary to preserve this thin filament, could not be maintained in a two-piece glass envelope, as the joint was often subject to leaks. He then made a very bold decision. He abandoned the two separable piece construction and with it the ability to replace a broken filament. He fused the two parts of the bulb inseparably together, saying, "I will make the lamps so long lived and so cheap that they can be thrown away when the filament burns out."



BULB BLOWING MACHINE

This ponderous machine turns out 50,000 bulbs per working day of 24 hours and greatly reduces their cost.

This one-piece glass chamber was one of the elements of the combination which he patented and which the courts decided covered all successful incandescent lamps. This glass chamber consists of two principal parts: the bulb, and the inside part, or stem, which carries the leading-in wires and filament.

* Edison Lamp Works, Harrison, N. J.

At first the bulbs were made by hand from one-inch tubing. Shortly after the lamp factory was started, bulbs were made at the Corning Glass Works, being hand made and free blown from glass taken directly from the furnaces. These free blown bulbs were used by the Edison Lamp Works for about twelve years, although other lamp manufacturers adopted molded bulbs much earlier. The hand made molded bulbs were uniform in size and shape, while the free blown bulbs varied a great deal and had to be gauged and sized into groups of similar dimensions.

The hand made molded bulbs were used for about twenty-five years before machines were developed to make them. Bulbs are now made by a ponderous automatic machine which takes the molten glass from the furnace in measured amounts, shapes it, blows it in a mold and delivers the molded glass bulb to another machine which removes the superfluous glass from the neck of the bulb. The completed bulbs are then automatically delivered to a conveyor which carries them through an annealing furnace to the inspectors where they are handled for the first time. Each machine has twenty-four arms on which the bulbs are made, the machine making 70,000 bulbs per working day of 24 hours.

Automobile headlight bulbs and bulbs for most miniature lamps are made from tubing in automatic machines which blow them in molds. A very few bulbs for special types of miniature lamps are still made by hand from tubing held in a horizontal lathe.

Stem Making

The inside part or stem is now and always has been made from tubing. Stems have passed through several

EARLY HAND BLOWN STEM, 1881

An enlargement was blown on a piece of glass tubing to which the neck of the bulb was sealed.

FLARED STEM, 1893

This was much simpler to make, less glass was used and the seal with the bulb was less liable to crack.

changes of form and methods of manufacture. In the very early stems, an enlargement was blown at about the center of a piece of tubing, the enlargement serving as a foundation to which the neck of the bulb was fused. The tubing was left long enough to be used as a holder while the stem was being sealed to the neck of the bulb. After this sealing-in operation, the extra length of tubing was cut off and thrown away. Later the enlargement on the stem tubing was omitted, the stem consisting of a straight piece of tubing with the leading-in wires sealed in one end. The tubing was still made long enough to hold the stem while it was being sealed in the bulb, the extra length then being cut off and thrown away.

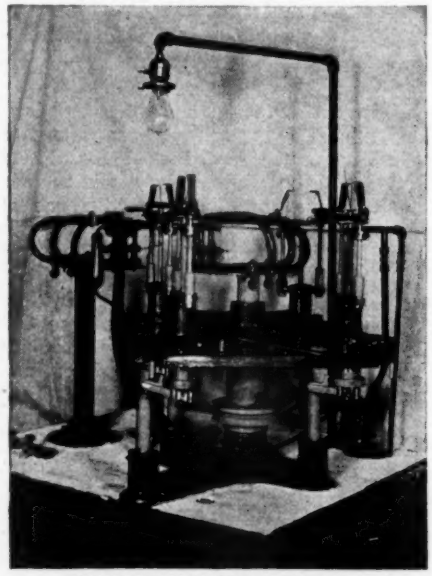
In 1893, the short stem with the flared end, which had been developed in the Thomson-Houston factory, was adopted. No glass was cut off and wasted in this stem and it made a seal which was less liable to crack than the older forms.

With this stem, as with all previous stems, the neck of the bulb was cut off the desired length and the stem sealed to the rim on the end of the neck of the bulb. Later this was changed, the long neck of the bulb was not cut off, the flared stem was inserted well inside the neck and the excess neck cut off by the sealing-in fires at the exact point where the flare joined the bulb. This was a great improvement. The seals had less glass in them and so were less liable to crack, and did not have to be annealed as was the case with the previous ones. The long bulb neck also kept the water vapor, formed by the combustion of the gas, from getting inside the bulb and so made the exhaustion of the lamps easier.

Stem Making Machines

All stems were made by hand until 1901, when J. W. Howell, aided by W. R. Burrows, made a successful stem making machine which is essentially the same as the present day machine. It was a four-head vertical machine which enabled unskilled labor to make two or three times as many stems per day as a skilled operator could by hand.

The flared stem tube was inserted in the heads, the two leading-in wires placed inside the tube, and the anchor wire (of the carbon lamp) put in a holder which held it in



STEM MAKING MACHINE, 1901

Stems were made by hand until this machine was developed by J. W. Howell, aided by W. R. Burrows. It enabled unskilled labor to make more than twice as many stems as skilled labor could previously produce by hand.

position so that its end was inside the tube. These were heated in three positions while the work rotated the hot end of the tube being squeezed into a flat mass, in the third position.

Flaring the Stem Tube

A number of different machines have been made for flaring the end of the stem tube. At first the pieces of glass tubing were placed in chucks by hand, the chucks rotating the tubing in the gas fires and the flare being formed by a hand tool. Later entirely automatic machines were made which placed the tubes in the chucks, formed the flares and delivered the flared tubes to the stem making machines.

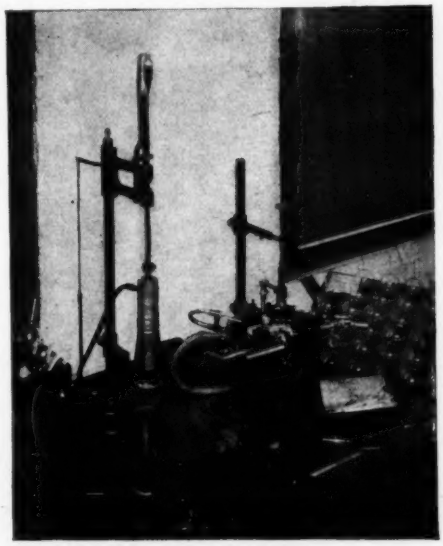
Other Flaring Machines

Other automatic machines have been developed which make the flares on the ends of long tubes, the gas fires cutting off the desired length of flared stem tube. This method is considered the best because the tubing is cut by the fires while it is soft, whereby cracked and irregular edges are eliminated.

Tubulating

The first glass working tool was the "bulb punch," developed by William Holzer, of the Edison Lamp Works, early in 1883. This tool punched a tit in the round end of the bulb, the glass at this point being softened by a gas flame. The protruding glass of the tit was afterward cut off, leaving a hole where the exhaust tube was later sealed on to the bulb.

About 1903, William R. Burrows developed a tubulating machine. A fine pointed gas flame was allowed to play



TUBULATING MACHINE, 1903

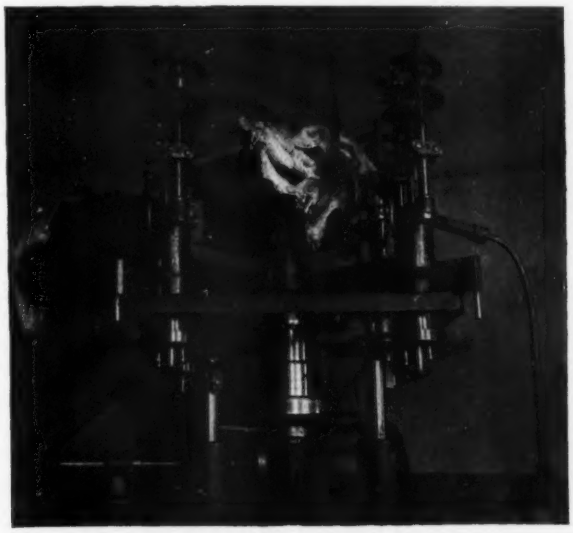
This machine was developed by W. R. Burrows. On the left, a hole was blown in the bulb by air pressure while the glass was softened by a gas flame. On the right, the exhaust tube was welded to the hole in the bulb.

on the rounded end of the bulb, a slight air pressure being put in the bulb. As the glass became softened, the air pressure blew a hole through the softened glass, blowing the flame away from the glass and so making the hole of uniform size. The exhaust tube was then welded to this hole. This machine remained in use about twenty years, or as long as bulbs were tubulated on the round end, and until the invention of the Mitchell and White method of tubulating the stem seal, which is described later.

Sealing-in Machines

The first glass working machine was a sealing-in machine, called the "Dufunny" and made by Edison about 1889, to seal the stem in the bulb. This was a single-head machine which simply held the bulb and stem in their proper relative positions while the two parts were sealed together. The machine held the work in a horizontal position, which is the natural position in hand working. While the machine enabled unskilled operators to perform the sealing-in operation, it did not increase the number an operator could produce in a day. The work rotated while it was being sealed in.

The first of the modern glass working machines was



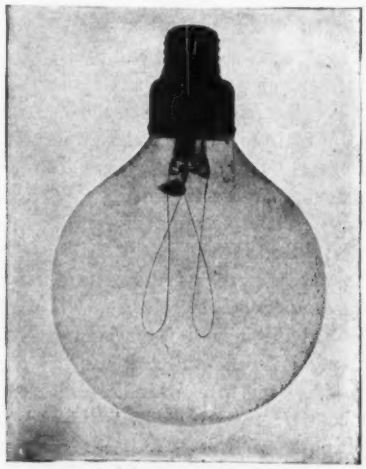
SEALING-IN MACHINE, 1896

This was developed by J. W. Howell and was the first of the modern machines. It is essentially the same as those now used and enabled the production per operator to be doubled.

the four-head vertical sealing-in machine, made by John W. Howell in 1896, and which was essentially the same as the sealing-in machine of the present day. The work rotated and was heated in three positions, increasing the speed of operation very much. With this machine an unskilled operator could complete 600 lamps a day, which was more than twice as much as could be done before. These machines were

TUBULATED SEAL

By welding a curved exhaust tube to the seal, the tip on the sealed exhaust tube would be covered by the base, making a "tipless" lamp. The construction was too expensive for the general product.



MERIDIAN LAMP, 1906

The exhaust tube was placed inside the stem tube, the two sealed together at the end. The leading-in wires were imbedded in glass protuberances made while the two were sealed together.

made just in time to enable the factory to take care of a large increase in production without increasing floor space.

"Tipless" Construction

The tip of glass left on the round end of the bulb has always been recognized as an objectionagle feature and many efforts have been made to get rid of it by tubulating the glass chamber in a position which would enable the tip to be covered by the base of the lamp, making a so-called "tipless" lamp. Many lamps have been made in previous years which were tubulated in the stem or at the seal of the bulb and stem, but the methods by which they were made were expensive and slow.

One tipless method of construction was to weld a tube on the rounded end of the lamp bulb as was done in making the standard tipped lamp, and weld the glass stem holding the filament to the bulb. After this weld had been made a fine pointed flame was allowed to heat the glass at the seal where the stem is welded to the bulb. When the glass became soft, air was blown into the tube on the bulb and blew a hole through this soft glass part of the flare. A piece of curved glass tubing was then welded to this hole for the subsequent purpose of exhausting the air from the lamp. The tube on the bulb was then melted off and the hole closed up by allowing the soft glass to flow together, so that the bulb looked the same as before. The air was then pumped out through the curved exhaust tube, which, when sealed off, was covered by the base.

Another method was to make a nick in the edge of the flare of the glass stem so that when the stem was sealed in the bulb this nick left a hole in the edge of the seal. The curved exhaust tube was then welded to this hole in the flare.

Meridian Lamps

H. D. Burnett and S. E. Doane, of the General Electric Company, obtained a patent in 1894 for a tipless construction which, however, was not commercially used until about twelve years later, and then used only on a special type of lamp called the Meridian lamp, designed for decorative purposes to compete with the Nernst lamp. It was possible to obtain a higher price on the Meridian lamp, as compared with the standard line of incandescent lamps, which warranted the expense of making it tipless.

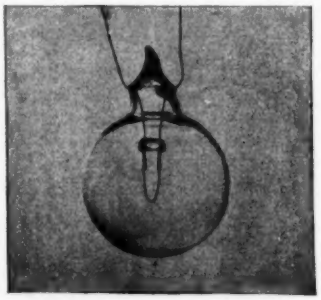
A machine was developed by Mark H. Branin, of the General Electric Company, for which he obtained a patent in 1906, to reduce the amount of handwork otherwise necessary in making the Meridian lamp. Inside the stem tube, in which the leading-in wires were later imbedded, a smaller diameter tube was placed through which the lamp was later exhausted. The end of the exhaust tube toward the inside of the lamp was flared and rested on a mandrel which projected into the exhaust tube.

The stem tube with the leading-in wires and exhaust tube were then heated at the end near the mandrel and when the glass was soft the parts were pinched together by a pair of pincers, which had a hole in the middle. This pinched the two glass tubes together so that a pair of glass "ears" were formed in which the leading-in wires were imbedded. The mandrel and hole in the pincers prevented the exhaust tube from collapsing.

This process had many difficulties and caused a large amount of spoilage. The operator had to watch the conditions existing in the machine very closely. If the mandrel supporting and holding the exhaust tube open during the pinching process in making the seal became heated too much the glass would stick to it and be drawn out of shape when the stem was removed. If the mandrel was too cool it was apt to cause cracks in the glass, so that a considerable percentage of the product was spoiled. With the advent of the more efficient tungsten lamp the popularity of the Meridian lamp soon waned, its manufacture being stopped in 1910.

Jaeger Tipless Lamp

In 1903, Herman J. Jaeger obtained a patent on a tipless construction which consisted of an "L" shaped exhaust tube sealed to the inside of the stem tube away from the



JAEGER TUBULATED STEM

An "L" shaped exhaust tube was sealed to the inside of the stem tube away from the pinched seal.

pinched seal. After the stem had been made in the usual way, this "L" shaped exhaust tube was inserted in the stem tube and a fine pointed flame heated a spot on the side of the latter. The bent portion of the exhaust tube was then welded to this heated spot in the stem tube and by blowing through the exhaust tube a hole was made through the stem tube. Thus the exhaust tube, when sealed off, was covered by the base, making a tipless lamp. This lamp was marketed by the Tipless Lamp Company.

The Stemless Butt Seal

Low volt miniature lamps used as indicators in telephone switchboards have largely been made tipless since about

STEMLESS BUTT SEAL

This construction has been in use for several years on miniature lamps, producing a tipless lamp.

1898. In 1913, this construction was applied to flashlight lamps and, in 1915, to side and rear automobile lamps. These lamps have no glass stem to support the short filament, it being supported entirely by the two leading-in wires held rigidly together by a globule of glass. The leading-in wires with the filament, are put inside the bulb, the wires bent over the edge of the neck of the bulb (which is of small diameter) and the flared end of a glass exhaust tube welded to the neck of the bulb, the leading-in wires being imbedded in the weld.

(To be continued)

Tentative Method for Complete Sand Analysis

Glass Division, Standards Committee, American Ceramic Society

NOTE: This method has been approved by the Standards Committee and is now issued to the committee for final perusal and criticism.

Preparation of the Sample

The sample may be a well-mixed unground portion or it may be ground in an agate mortar.

Solution of the Sample

Weigh out a 10-gram sample and place it in a platinum dish of suitable size; 250 cc is recommended. Moisten the sample with water and add 2 cc concentrated sulphuric acid. Fill the platinum dish two-thirds full with concentrated hydrofluoric acid and evaporate on the sand bath, or if so desired on the hot plate with an asbestos board beneath, to a volume of about 50 cc. Examine the contents of the dish and if complete solution of the sample has not taken place add more hydrofluoric acid and evaporate again. When complete solution of the sample has been accomplished evaporate to copious fumes of SO_3, add one or two drops of fuming nitric acid to oxidize any organic matter. Cool the solution, dilute to about 100 cc, filter and transfer any residue left in the platinum dish to the filter. Wash the filter 5 times with hot water, place in a covered platinum crucible, dry and ignite until the filter paper has entirely burned off. Cool the crucible, add about 2 grams of sodium carbonate and fuse over a Meker burner or its equivalent. Cool the crucible and dissolve the melt with dilute hydrochloric acid and hot water in a small beaker. If a residue still remains after this treatment, filter into the main solution and wash four times with hot water. Dry and ignite the filter in a platinum crucible and fuse with one gram of potassium pyrosulphate. Dissolve the melt in dilute hydrochloric acid and hot water and add to the main solution. Evaporate the total solution in a platinum dish, porcelain casserole, or Pyrex beaker to dryness on the water bath. Bake at 110°C for one hour. Cool the dish, add 25 cc dilute hydrochloric acid and allow to stand on the water bath 15 minutes with the dish covered. Add 50 cc of water and allow to stand 5 minutes. Filter the solution and wash 6 times with hot water.

R_2O_3

Heat the filtrate from "Solution of Sample" to boiling, add 2 or 3 drops of methyl red indicator and then dilute ammonium hydroxide drop by drop to a yellow end point. Boil from 1 to 2 minutes and filter immediately. Transfer the contents of the dish or beaker to the filter with hot 2% neutral ammonium chloride and wash 5 times with this solution. Dissolve the precipitate in the minimum amount of hot hydrochloric acid (1-10) receiving the washings in the original beaker in which the precipitation was made. Wash the filter 5 times with hot water. Precipitate again as before with the aid of macerated filter paper if desired to aid in filtering. Transfer the precipitate quantitatively to a filter with hot neutral 2% ammonium chloride or ammonium nitrate and wash 6 times with either of these solutions. Place the precipitate in a previously ignited and weighed platinum crucible, dry and ignite to constant weight under good oxidizing conditions at 1,100°C.

CaO

Combine the filtrates from the two R_2O_3 precipitations, make slightly acid with hydrochloric acid and evaporate to a volume of 150 cc. Add a slight excess of ammonium hydroxide and heat to boiling. Add slowly with constant stirring 10 cc of a 4% solution of ammonium oxalate and boil 5 minutes. Let stand on steam bath for at least 4 hours or over night. Filter and wash with hot 1.5% ammonium oxalate solution 6 times. Place in an ignited and weighed platinum crucible, dry and ignite to constant weight as CaO.

MgO

Make the filtrate from the CaO precipitation slightly acid with HCl, and add ½ gram of diammonium phosphate ($(NH_4)_2HPO_4$). Evaporate to 150 cc and cool. Add ammonium hydroxide slowly to a slight excess. Stir vigorously until the magnesium begins to precipitate. After several minutes add (conc.) ammonium hydroxide to make one-ninth by volume. Let stand over night. Filter on a previously ignited and weighed Gooch crucible or on filter paper if desired, wash with 5% by volume ammonium hydroxide 5 times, dry, and ignite gently. Finally ignite to constant weight at 1,100°C as $Mg_2P_2O_7$.

Ignition Loss

Ignite 5 grams of sample at 1,100°C in an ignited and weighed platinum crucible to constant weight. Report the loss in weight of the sample as ignition loss.

The Determination of Iron as Fe_2O_3

NOTE: This method for determination of iron has already been accepted tentatively by the Glass Division.

Weigh a 10-gram sample of the sand into a platinum dish of 150 cc capacity. (It is not necessary to grind the sand.) Moisten the sample with distilled water and add 2 cc concentrated H_2SO_4. Mix thoroughly by shaking the dish. HF (C.P. 48%) is now added until a few drops no longer produce any reaction.

NOTE: This reaction is not violent unless the sand is ground.

Fill the dish with HF, place on the sand bath or hot plate, and evaporate.

The sand becomes flocculent and may completely dissolve. In the latter case, the evaporation is carried to H_2SO_4 fumes, rapidly at first, then carefully to avoid loss by spattering.

In case the solution is not complete carry the evaporation down half-way, then refill the dish with HF, and evaporate to H_2SO_4 fumes and dryness.

From *Jour. Amer. Soc.*, July, 1927.

Ignite the dish containing the residue for a few minutes at 1800°F to drive off any excess H_2SO_4 and burn out any organic matter than may be present.

Cool the dish containing the residue and add 25 cc HCl 1:1, cover with a watch glass, heat to boiling and filter into a 500 cc Erlenmeyer flask. Wash the filter paper three times with hot H_2O.

Return the paper to the dish and ignite. Make a quick fusion with Na_2CO_3 (2 grams, 5 minutes). Dissolve the melt with HCl 1:1 and add to the Erlenmeyer flask, disregarding any silica that may have been carried over. Add 1:1 HCl (and concentrated HC equal to the volume of wash water used) to bring the volume up to 150-200 cc. Cover with a watch glass and heat to boiling. Cool the neck of the flask with a stream of cold water. Reduce the iron with stannous chloride (minimum number of drops). Adjust the titration head, insert the buret tip, and titrate with standard $K_2Cr_2O_7$ while recording the potential by means of a Roberts Electrometric Titration Apparatus. From the potential-titration curve ascertain the number of cubic centimeters of $K_2Cr_2O_7$ solution required by the iron chloride in the solution.

Calculate the percentage of total iron as Fe_2O_3. Report as Fe_2O_3. A blank is run on the reagents used and the blank subtracted from the titration.

NOTE: It was found necessary to avoid high results of Fe_2O_3 in U. S. Bureau of Standards glass sand, No. 81 to remove the H_2S metals from acid solution before the $K_2Cr_2O_7$ electrometric titration.

Determination of Titania and Zirconia

Fuse the ignited and weighed R_2O_3 residue with 1-2 g of potassium pyrosulphate and take up the melt in 30 cc of dilute sulphuric acid (1:9).

(*A*) *Determination of Titania*

Transfer the solution to a Nessler comparison tube, rinse with a very little of the acid, add 3 cc of fresh hydrogen peroxide and dilute with the acid to 50 cc. In another tube dissolve an equal amount of pyrosulphate in the dilute acid, add 3 cc of the peroxide and dilute with acid to the same volume. To the comparison tube add a standard solution of titanium sulphate, $Ti(SO_4)_2$, until the colors in the two tubes are exactly the same when the solutions are thoroughly mixed. The amount of titanium oxide added, divided by the total volume of the solution represents the amount of titania per cc of the unknown solution. This value multiplied by 50 represents the amount of titanium oxide in the sample taken for analysis. It is not likely that a glass sand will contain so much titanium that the color in 50 cc of a solution obtained from a 1 g sample will be too strong for colorimetric comparison.

The standard solution of titanium sulphate can be prepared from titanium oxide of known purity or from potassium titanium fluoride, K_2TiF_6. The former can be fused with potassium pyrosulphate, the melt dissolved in dilute sulphuric acid and the solution diluted to the desired volume with the same acid. If the fluoride is used, purify the salt by crystallization from hot water in platinum and dry the crystals. Treat the calculated weight of the dried crystals with sulphuric acid in platinum, evaporate to fumes, cool the solution and wash the walls of the vessel with water. Repeat the evaporation and washing twice to make sure that all fluorine is expelled. Cool the solution, prepare a dilute sulphuric acid (1:9) solution of the desired volume, and determine its titre by precipitation with ammonia and final ignition to TiO_2.

(*B*) *Determination of Zirconia*

To determine zirconia add 5.0 g of diammonium phosphate, $(NH_4)_2HPO_4$, to the solution that was used for the determination of titania and which should still contain hydrogen peroxide and approximately 10% of sulphuric acid by volume. Cover and allow to stand overnight at a temperature of 40 to 50°C. Hydrogen peroxide must be present in excess at all times. If a precipitate appears, filter the solution and wash the paper and precipitate with a cold 5% solution of ammonium nitrate. Dry the paper and precipitate in a weighed platinum crucible, cautiously burn off the carbon, and finally heat at approximately 1000°C. Cool and weigh as ZrP_2O_7 which contains 46.3% of zirconium oxide.

Al_2O_3

Alumina is determined by subtracting from the total R_2O_3 the percents found for Fe_2O_3, TiO_2, and ZrO_2.

SiO_2

Silica is determined by difference by subtracting the percentages of R_2O_3, CaO, MgO and ignition loss from 100.

Blank

Run a blank using exactly the same amounts of chemicals as in the original analysis. Subtract any impurities found from the amounts found in the analysis of the sand.

Measures Glass Expansion by Light Waves

The Bureau of Standards has succeeded in measuring the thermal expansion of tiny pieces of glass less than seven one-thousandths of an inch in length. The actual change in length measured was about two-thousandths of an inch.

Everyone knows that common materials expand with heat and contract with cold, and it is likewise common knowledge that for most substances this change is very small. However, in certain cases a knowledge of the exact amount of this change in length with change in temperature is most important.

For instance, in the manufacture of glazed ceramic ware the expansion of the body and glaze must be approximately equal or the latter will crack during firing or in service. This cracking of the glaze is very similar to the pushing up of ice on a pond in severe weather, in other words nearly all "crazing," as it is called, appears to be the nature of thrust cracks. The difficulty is to secure samples of the glass long enough to permit measurements of their thermal expansion to be made with any accuracy.

This the Bureau has succeeded in doing by using the interference of light waves as the method of measurement.

CLOCKS, WATCHES AND PARTS. Census of Manufactures, 1925. An indication as to the extent of the watch crystal business is given in this report, which shows that in 1925, 38 establishments were manufacturing clocks to the number of 10,972,594, 6 establishments were manufacturing clock watches (non-jeweled watches) with a production of 9,213,138, watch cases were made to the number of 4,720,689 by 46 establishments and time recording devices, including watchmen's clocks, amounting to 40,381 by 12 establishments.

The Laboratory

Carbon Dioxide in Burnt Lime

Burnt lime is used extensively in the production of flint glass bottles and of blown and pressed tank ware. One of the disadvantages of its use lies in the fact that burnt lime has a tendency to take up moisture and carbon dioxide in storage, which renders the composition of the material uncertain. For this reason rapid methods to determine carbon dioxide in burnt lime are of interest to the glass chemist. The following methods which have given satisfactory results in practice are submitted for consideration:

METHOD 1. This procedure is based on the decomposition of the lime by hydrochloric acid, absorption of the liberated carbon dioxide in barium hydroxide solution and subsequent weighing of the resulting barium carbonate, or its volumetric determination.

The form of apparatus is shown in Fig. 1. Compressed air is admitted to the U-tube A. containing soda lime. Separatory funnel B serves to introduce the acid to the evolution flask C, fitted with a two-hole stopper. The Drechsel bottle D serves to condense the steam and acid, which distills over during heating. E is a Meyer tube, containing barium chloride solution.

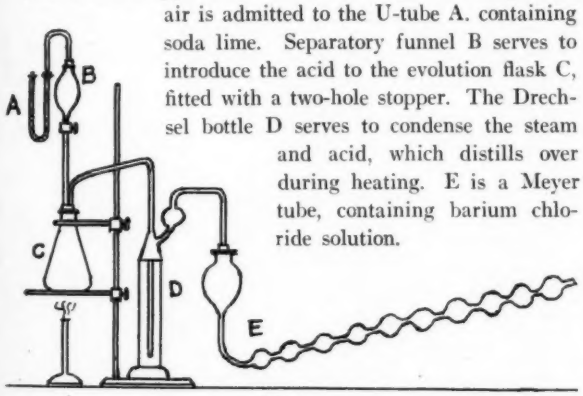


FIG. 1

PROCEDURE. Weigh out from 2 to 10 grams of the sample, depending on the amount of carbon dioxide present, transfer to flask C and add about 50 cc. of CO_2-free water. Displace the air by a current of CO_2-free air. Fill seven of the ten bulbs of tube E with clear barium hydroxide solution (containing 20 grams per liter), attach to the apparatus, close the stopcock of the separatory funnel B and fill half full with HCl, 1:1. Replace the stopper and allow the acid to flow in the flask. Heat with a small flame, keeping the air current going through the apparatus, and bring to a quiet boil. After a few minutes, turn off the gas, increase the air current and allow the flask to cool. Disconnect the Meyer tube, filter the barium carbonate, wash with CO_2-free water, filter, ignite the precipitate at a dull red heat and weigh as $BaCO_3$.

Calculation: $$\frac{\text{Grams of } BaCO_3 \times 0.2229 \times 100}{\text{Weight of sample}} = \%\ CO_2$$

$\%\ CO_2 \times 2.2743 = \%\ CaCO_3$.

To determine the carbon dioxide by titration proceed as follows: Put the filter paper and contents in a small flask, add an excess of N/10 HCl and shake the flask to open the paper, heat on a hot plate until the carbonate has dissolved, add a few drops of methyl orange solution and titrate the excess of acid with N/10 NaOH.

Calculation:

$$\frac{\text{cc. N/10 HCl} - \text{cc. N/10 NaOH} \times 0.0022 \times 100}{\text{Weight of sample}}$$

$= \%\ CO_2$.

Instead of using a chemical indicator for the end point, the carbon dioxide may be determined by electrometric titration,

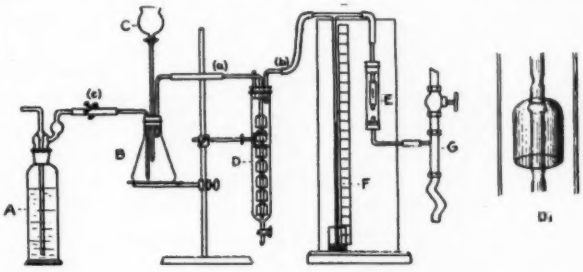


FIG. 2

A—Gas Washing Bottle (Containing 30% KOH solution). B—Wide Mouth Erlenmeyer Flask (200 cc. capacity). C—Extraction Funnel. D—Absorption Tube (Shown in detail at D_1). E—Bunsen Valve. F—Mercury Suction Gauge. G—Suction Pump.

measuring the change in resistance of the solution by means of a potentiometer, as the $Ba(OH)_2$ is precipitated from solution as $BaCO_3$. For details of this method consult Technical Paper 141, Bureau of Standards.

METHOD 2. This procedure is based on the decomposition of the calcium carbonate with dilute hydrochloric acid, under reduced pressure. The CO_2 is absorbed in standard sodium hydroxide solution. Barium chloride is added and the excess alkali titrated with standard HCl.

PROCEDURE. Weigh out from 2 to 10 grams of the sample, depending on the amount of carbon dioxide present, and connect the apparatus as shown in the illustration. Close screw clamp (c). Charge absorption tube D with 75 cc. of N/10 NaOH, measured by means of an automatic overflow pipette. Add sufficient CO_2-free water to cover the floats and add a few drops of phenolphthalein indicator. Run in 40 cc. of HCl (1:10) from funnel C and turn on the suction very gradually, until it equals 18 inches of mercury. Open screw clamp (c) sufficiently to allow a slow current of air to pass through the apparatus (30 to 40 bubbles per minute in bottle A). Continue the air current with frequent agitation of flask B, shut off the suction and disconnect the absorption tube at points (a) and (b) and remove from the clamp. Run the contents of the absorption tube into an Erlenmeyer flask and wash the tube with CO_2-free water. During washing the tube should be revolved sufficiently to wash the inner surface of the floats. Add 5 cc. of neutral barium chloride solution (10 per cent) and titrate with N/10 hydrochloric acid, using phenolphthalein indicator.

Calculation:

$$\frac{\text{cc. N/10 NaOH} - \text{cc. N/10 HCl} \times 0.0044 \times 100}{\text{Weight of sample}} = \%CO_2$$

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CONTRIBUTIONS

THE EDITOR welcomes practical articles on all subjects related to GLASS MANUFACTURING. Such articles, if accepted, will be paid for at our usual rates.

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Trusts and the Small Producer

For the second time in this century we have entered upon an era of consolidation of a number of relatively small concerns, competing with each other, into large organizations, serving collectively territories formerly covered by firms that were fighting for business with every means at their disposal. About 1900 we witnessed the formation of the big steel and oil trusts, and of mergers of many other groups of producers. In recent years the tendency has been marked in the formation of large holding corporations of public utilities, of banks, of chemical companies—one of which now covers the whole field of inorganic chemicals—and of combinations producing raw materials for various fields.

The big glass sand merger, completed a few months ago, is one of the important developments affecting the glass industry, and doubtless others are to follow.

The formation of these powerful combinations is giving serious concern to men engaged in various lines of industry. Competition between firms of about equal size is one thing. Competition with groups of former competitors, having all the advantages of decreased overhead, centralized effort, combined research facilities and advertising power and the economies of division of territories, is altogether different.

However, in the present instance, the manufacturer has the advantage of the lessons taught by history. Although since 1900 a large number of powerful combinations have grown and expanded far beyond the fondest hopes of their promoters, yet the small, independent producers have been able to keep up the fight, and to grow, sometimes at greater speed than the colossus.

The large combination, with all its advantages, has its inherent weaknesses. It has the defects of its good qualities. While it has efficiency, it also has red tape. It has delays of getting things done, the long winding road from department to department. Also, large organizations fail to develop men who have that personal interest in the welfare of the concern that is an incentive to attention to detail, the special province of the firm of smaller size. All who have dealings with large organizations have at times despaired of the inertia to be overcome. It minimizes to a large degree the much vaunted "efficiency" of the large corporation.

The small firm has the flexibility to meet rapid changes in market conditions, the needs and tastes of the moment. It has the advantage of the personal touch, the ability of giving special attention to the things that often win customers away from big organizations with their set ways and impersonal manner. These are some of the reasons why the small firm has survived and often prospered. In merchandizing, the big department store has not prevented the growth of the specialty shop. In manufacturing, large combinations have not crushed the small producer, for much the same reasons.

The human element in business is not a thing of the past; it never will be. In spite of the menace of the "big fellow," the small concern will have its chances, provided it will make the best of the advantages due to its smaller size.

Present day consolidations, viewed in the light of history, have lost much of their terrors. The manufacturer who will study history will derive comfort, and considerable practical advice from reviewing the trend of the times since 1900.

Notes on the Analysis of Glasses

In a communication to the Society of Glass Technology discussing "Notes on Some Methods Used in the Analysis of Glasses," by Violet Dimbleby, presented at the Sheffield meeting, February 16, 1927, and published in the Society's *Journal* of June, 1927, Prof. W. E. S. Turner said:

"Mr. Withey in his opening remarks referred to two tests undertaken in America more than 20 years ago to ascertain the degree of accuracy with which experienced analysts could determine the composition of silicate mixtures, such as Portland cement, supplied to them. The results were very far from satisfactory. Mr. Withey remarked, and he (Prof. Turner) quite concurred, that the standard of analysis had now greatly improved. Nevertheless, the results of the analyses of standard glass recently sent out by the Standards Committee connected with the Glass Division of the American Ceramic Society indicated the necessity for the full and free discussion of analytical methods such as had taken place that afternoon. Returns of results of the standard glass in question were received from 24 laboratories. The silica determinations for the 24 results ranged between 73.23 and 74.88 per cent.; the calcium oxide between 4.60 and 5.53 per cent.; the magnesia between 2.07 and 3.59 per cent.; the sodium oxide between 15.71 and 17.64 per cent. These divergences could not be regarded as otherwise than unsatisfactory. Nevertheless, there were several in reasonably good agreement with those obtained by the Bureau of Standards, Washington, and the Department of Glass Technology, Sheffield. The results obtained by these two last-named institutions were: for silica, 73.96 and 73.93 per cent. respectively; iron oxide and alumina, 0.44 and 0.44 per cent.; calcium oxide, 4.80 and 4.85 per cent.; magnesium oxide, 3.15 and 3.18 per cent.; sodium oxide, 16.86 and 17.54 per cent.

"With the exception of the sodium oxide determinations, which would bear looking into, the agreement for all the other constituents was remarkably close, and showed what could be done by experienced analysts working by carefully considered methods. He (Prof. Turner) also understood that the National Physical Laboratory, when occasion had arisen to analyse any of the glasses of the Department of Glass Technology, had found very good agreement. The general agreement indicated that afternoon on all essential points relating to methods of analysis showed that the skilful analyst might be thoroughly relied on in the control of glass compositions. He could already duplicate his own results and, given a set of standard methods, there was evidence to believe that different analysts would furnish analyses in good agreement.

"It might be assuring to glass manufacturers to know that the skilful chemist was now thoroughly competent and able, by analyses of the glass produced, to check errors due to the batch-mixing department; and there could be no gainsaying the verdict of the analyst. The analyst was also in the position to check for the glass purchaser or user whether or not the glass supplied complied with a specification. It was possible, indeed, to go still further in a number of cases. Thus, the work of the analyst sometimes made it possible to determine the source of manufacture of the glassware in question. This was possible where the analyst also had a wide knowledge of processes of manufacture. In the manufacture of window glass, for example, despite the fact that the composition used by a large number of manufacturers was somewhat similar in type, there were perfectly definite variations associated with the method by which the sheet glass was manufactured. In the last few years there had, indeed, been rather a growing divergence in composition of window glass to suit the varying processes, particularly the new machine processes employed. Certainly the manufacturers of such glass who kept their own scientific staff had no difficulty, quite apart from indications given by general appearance, in identifying their own glass by the method of chemical analysis, because of the preciseness with which chemical analyses could now be carried out by skilled workers using well-standardized methods. . . . Not until manufacturers of any one particular glass were all using the same standard mixture for glass-making would any serious difficulty arise to prevent them from identifying their own products. We were still a long way from such a degree of standardization, and it remained definitely true that the skilled analyst could determine and differentiate between different samples of glass by chemical analysis, despite their slight superficial differences."

Correspondence

Kryolith and Synthetic Cryolite

TO THE EDITOR:

In your June issue, page 141, we notice a letter from a correspondent quoting what is said to be a typical analysis of the usual run of Greenland kryolith. According to this analysis, Greenland kryolith is 99.37 per cent pure and shows silica 0.04 per cent.

A Greenland kryolith with as low as 0.04 per cent SiO_2 and 0.10 per cent Fe_2O_3 is not known to people with many years' experience in this line. A sample of Greenland kryolith only recently obtained in this market, was found upon examination to show almost 1 per cent SiO_2 and 0.38 per cent Fe_2O_3. Other samples tested in the past have actually shown as high as 4 per cent SiO_2 so that your statement in your article on the "Manufacture of Light Diffusing Glass" was entirely justified.

As to the iron in the crude Greenland kryolith, the statement that it is magnetic and removable refers only to the iron found between the kryolith particles. Within these particles there is iron which nobody can remove, and you must know from your own experience in the use of Greenland kryolith that it often contains iron to an extent which is decidedly bothersome.

We know that the comparison—"the iron contamination in the manufacture of synthetic kryolith is non-magnetic and cannot be removed"—is imperfect as far as our synthetic cryolite is concerned. In the manufacture of this product, no raw materials are used which contain iron to the extent to be found in the crude Greenland kryolith with the possible exception of fluorspar the iron content of which, however, remains in the retort residue and would have to be volatile in order to get into the hydrofluoric acid which serves for the manufacture of our synthetic cryolite. There is no necessity, therefore, to remove any iron from this product.

For the benefit of the consuming industries, we believe you will want to give these facts proper publicity.

Yours very truly,

JUNGMANN & CO., INC.

(Signed) P. Gutschow, Pres.

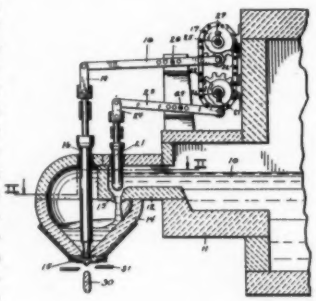
New York, July 8, 1927.

Recent Patents

NEW INVENTIONS DESIGNED TO IMPROVE GLASS AND THE MEANS OF PRODUCING IT

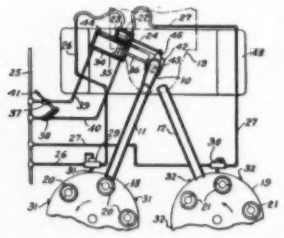
Complete copies of U. S. Patent Specifications may be obtained from the Commissioner of Patents, Washington D. C. Price 10c each

DRAWING OF GLASS IN SHEET FORM AND APPARATUS THEREFOR. U. S. 1,637,961. Aug. 2, 1927. Eugene Rowart, Auvelais, Belgium, assignor to Pilkington Brothers, Limited, of England. The width of the sheet is maintained by forming the edges from glass coming from a source independent of the main pot. The inventor claims the combination with a main pot containing the glass from which the main body of the sheet is drawn and a drawing chamber containing the main pot, of two chambers within the main chamber, a subsidiary pot in each of the two last-named chambers, a discharge neck on each subsidiary pot adapted to supply glass to the surface of the main pot at the point of draw of each edge of the sheet, and sources of glass supply for the subsidiary pots independent of that of the main pot.



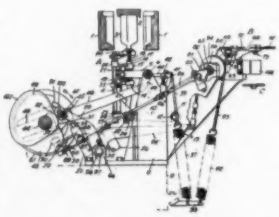
SHEET-GLASS WIDTH-MAINTAINING SHIELD. U. S. 1,639,453. Aug. 16, 1927. Enoch T. Ferngren, Toledo, O., assignor to Libbey-Owens Sheet Glass Co. Filed 12/26/24. Includes a construction whereby heat may be directed along the border portions of the source of molten glass from which the sheet is drawn.

DELIVERY APPARATUS FOR MOLTEN GLASS. U. S. 1,637,452. Aug. 2, 1927. Ernest G. Nelson, Hartford, Conn., assignor to Hartford-Empire Co. Filed 1/6/26. A glass delivering apparatus adapted to receive charges of molten glass from a glass feeder and deliver them to a plurality of glassware shaping machines, comprising a deflector, a movable support for the deflector, means for moving the deflector on said support to deliver charges of glass alternately to the shaping machines, and means for moving the support and the deflector bodily into and out of glass-receiving position.



DRAWING SHEET GLASS. U. S. 1,639,466. Aug. 16, 1927. Joseph A. Reece, Toledo, O., Assignor to the Libbey-Owens Sheet Glass Co. Filed 5/29/24. The method consists in supplying a draw-pot with sub-surface glass from a glass melting furnace, drawing a sheet vertically therefrom, and flowing from said pot any surplus glass contained therein.

GLASSWARE-TRANSFERRING DEVICE. U. S. 1,637,490. Aug. 2, 1927. Edward H. Lorenz, West Hartford, and John Davis, East Hartford, Conn., assignor to Hartford-Empire Co. Filed 8/25/25. One object is to minimize shocks and jars to which articles of glassware may be subjected when removed from the molds of a glass shaping machine in an inverted position, reverted and transferred to a suitable point of delivery within the relatively short interval of time between the arrival of successive molds at the take-out station. Among the inventor's claims is a take-out device including a pair of tongs for removing ware from said mold and conveying it a portion of the distance toward a delivery station, and a second pair of tongs for receiving the ware from said first-mentioned pair of tongs, conveying it the remainder of the distance toward said delivery station and at an angle to the path of travel of said first-mentioned pair of tongs, and depositing the ware at said delivery station in a neck-up position and angularly displaced relative to its initial angular position in said mold.



EYE-PROTECTIVE GLASS. U. S. 1,637,439. Aug. 2, 1927. William Weber Coblentz, Washington, D. C., assignor to Secretary of Commerce of the United States, as Trustee for the Government of the United States, and the People of the United States. Filed 6/10/26. This invention may be used by the Government of the United States or any of its officers and employees or by any other persons in the United States without payment to me of any royalty thereon.

Colored glasses have been used for years to protect the eye when looking at bright lights or into furnaces, but these glasses have not given the proper protection; or if protection has been given, then they have not heretofore possessed other desirable characteristics, such as proper and preferred color, ample visibility, etc.

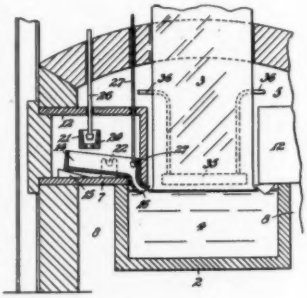
They do not absorb or "cut out" the harmful ultra-violet rays. In certain industries a glass of blue color preferably of cobalt origin is desired, and heretofore regardless of the fact that such glass by itself gives only partial, if any, protection against the harmful ultra-violet rays, the workers in such industries have persisted in using such glasses maintaining that they can observe furnace conditions better through a blue rather than through other colored glasses which do give the protection.

This invention comprises a new composition of matter.

	Per cent.
SiO_2	60 to 80
CaO	0.0 to 12
CeO	5 to 10
CoO	0.1 to .5
NaO_2	12 to 25

A glass containing the usual glass-making constituents and sufficient cobalt oxide to give a blue color equivalent to blue 20 + 8 on the Lovibond scale, sufficient cerium oxide to stop the ultra-violet rays and to absorb the majority of the infra-red rays while permitting the transmission of approximately 1½ per cent of visible light.

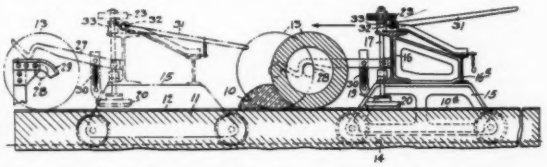
GLASS FEEDER. U. S. 1,636,875. July 26, 1927. Leonard D. Soubier, Toledo, O., assignor to the Owens Bottle Co. Filed 3/5/24. The combination of a container for molten glass having an outlet opening through which the glass is discharged downwardly, a second container below said outlet and having an outlet opening in its bottom, said second container arranged to entirely enclose the first outlet opening and receive the glass discharged from the first mentioned container, the walls of the second container converging downwardly toward the second outlet opening, regulating plungers in said containers, and means for periodically reciprocating said plungers toward and from the respective openings.



APPARATUS FOR ANNEALING GLASSWARE. U. S. 1,638,401. Aug. 9, 1927. Otto C. Kuhrt, Mt. Vernon, N. Y., assignor to Hartford-Empire Co. Filed 1/13/26. Means for preventing ware from frictionally engaging the walls of the lehr by upper and lower chains mounted in guideways and driven at the same speed as the conveyor.

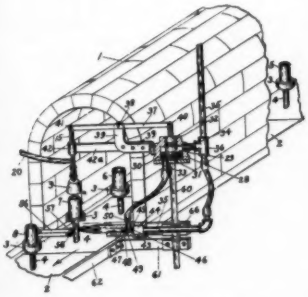
METHOD OF AND APPARATUS FOR CONVEYING GLASS. U. S. 1,638,593. Aug. 9, 1927. Vergil Mulholland, West Hartford, assignor to Hartford-Empire Co. Filed 8/19/24. Depositing molten glass on guideway and admitting gas under pressure to the surface of the guideway to lubricate the same and exert a propelling force on the glass.

PROCESS OF AND APPARATUS FOR MAKING SHEET GLASS. U. S. 1,637,881. Aug. 2, 1927. Richard O. Stilwell and Charles H. Christie, of Butler, Pa., assignors to Standard Plate Glass Company. Filed 8/6/25. The inventor claims the method of smoothing plate glass, which comprises forming a sheet of glass by rolling a mass of plastic glass, advancing a smoothing member across the surface of said sheet while still plastic, and simultaneously rotating said member independently of its advancing movement; and sheet glass forming apparatus comprising a forming roll, an ironing block, means for advancing said ironing block across the sheet of glass as said sheet is being formed by said roll, and means for rotating said block independently of its advancing movement.

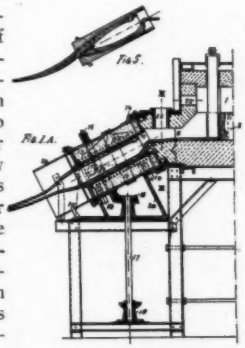


DRAWING SHEET GLASS. U. S. 1,639,452, Aug. 16, 1927. John L. Drake, Charleston, W. Va., assignor to Libbey-Owens Sheet Glass Co. Filed 5/15/24. A pair of small edge-forming rollers grip each sheet edge at its source.

METHOD AND APPARATUS FOR SHAPING ARTICLES OF GLASS. U. S. 1,638,620 Aug. 9, 1927. Virgil O. Cornwell and Albert Moeller, Columbus, O., assignors to the Federal Glass Co. Filed 3/17/23. The method of "cupping in" the open ends of tumblers which comprises heating a formed tumbler and passing a shaping member over the open end thereof, while supporting the interior by fluid pressure, and means for carrying the article to be shaped, means for heating the article while it is being moved along, and means for applying a bending stress to the exterior surface of the upper portion of the walls of said containers without interfering with their course of travel.

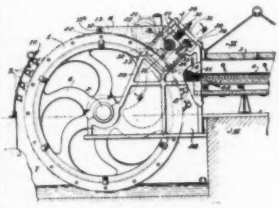


METHOD AND MEANS FOR THE CONTINUOUS MANUFACTURE OF GLASS TUBES OR RODS. U. S. 1,637,458. Aug. 2, 1927. Pancras Schoonenberg, of Eindhoven, Netherlands, assignor to Naamlooze Vennootschap Philips' Gloeilampenfabrieken, of Eindhoven, Netherlands, a limited liability company. The method of continuously drawing glass tubes which comprises permitting molten glass to flow into and causing it to form a layer on the inner surface of a rotating hollow glass forming member inclined towards its discharge opening, heating said layer both from the inside and through the wall of said member, always maintaining the interior of the tube out of contact with any solid during the formation of the tube, and then drawing the glass from the discharge opening of the member in cylindrical form,.



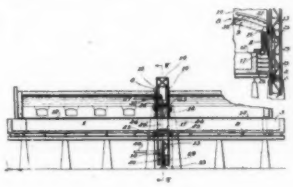
APPARATUS FOR TRANSFERRING GLASS ARTICLES. U. S. 1,638,920. Aug. 16, 1927. Albert N. Cramer, Toledo, O., assignor to Owens Bottle Co. Filed 4/3/24. Articles delivered from forming machine may be transferred to lehr pans located at a greater distance from machine than has heretofore been practicable.

APPARATUS FOR MAKING SHEET GLASS. U. S. 1,638,728, Aug. 9, 1927. John H. Fox, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co. Filed 3/18/26. A casting roll of large diameter mounted for rotation, a driven sizing roll above the casting roll positioned so as to provide a pocket between the two rolls for receiving the molten glass to be rolled, bearings in which the sizing roll is journaled mounted for movement toward the casting roll, spacing means mounted to move with said bearings in fixed relation thereto and contacting with the periphery of the casting roll, and a runway for receiving the glass sheet formed between the rolls.



GLASS-SURFACING MACHINE. U. S. 1,638,768. Aug. 9, 1927. Halbert K. Hitchcock, Pittsburgh, Pa., assignor to Pittsburgh Plate Glass Co. Filed 4/22/25. Means for securing the plates or sheets to the cars employed on a straight away grinding and polishing operation without the use of plaster of paris. A suction system is employed.

GLASS-MELTING TANK. U. S. 1,638,737, Aug. 9, 1927. Karl G. Kutckka, Wilkinsburg, Pa., assignor to Pittsburgh Plate Glass Co. Filed 12/10/25. Means for improving the independent control of the temperatures in the two ends of the tank. A movable furnace section having its top portion in the form of an arch following the contour of the roof or arch of the furnace and mounted for vertical adjustment, so that any desired degree of separation may be secured between the regenerator, or melting end of the tank, and the working or withdrawing end.



New Book

Scientific Instruments—Bulletin of developments covering the year ending June 30, 1926, issued by Adam Hilger, Ltd., 24 Rochester Place, Camden Road, London, N. W. 1. England. Describes recent developments of the company including a new universal lens, Interferometer, N 59, which has been used by the National Physical Laboratory for certification of camera lenses. This series of interferometers has been designed for the testing of optical elements, and instruments have been supplied to the following concerns: Chance Bros. & Company, Ltd., Birmingham, England; Cooke, Troughton & Simms, Ltd., Buckingham Works, York, England; Japan Optical Company, Tokyo, Japan; Officine Galileo, Via Carlo Bini, 24, Florence Italy; Ross Limited, Optical Works, Clapham Common, London, S. W. 4, England; and Taylor, Taylor and Hobson, Ltd., Stoughton Street Works, Leicester, England.

The bulletin describes also the Ultra-Violet Spectroscope, E 69, a simple ultra-violet spectrograph, originally designed for investigations in connection with light therapy, which has been found a very useful accessory for physical and chemical laboratories. In this instrument the absorption for the ultra-violet rays of transparent substances of chemical interest can be seen at a glance, as can the character of radiations emitted in the ultra-violet regions by various light sources. The instrument is cheap and convenient. Other developments are improvements in Dr. Müller's Universal X-Ray Spectrograph for commercial micrometers. The bulletin also covers the development of the Guild Trichromatic Colorimeter, H 93; Photo-measuring Micrometer and students' and Industrial Polarimeter, M 191.

Summer Meeting of the Glass Container Association

At the Clifton Hotel, Niagara Falls, Ontario, high up on the Canadian cliff between waterfall and whirlpool, the summer meeting of the Glass Container Association took place on Thursday and Friday, July 28 and 29.

On Thursday, the members listened with pleasure to an interesting program and committee reports. President Frank Ferguson was in the chair and introduced F. Stuart Fitzpatrick of the United States Chamber of Commerce, who read a paper on "Where the Trade Association Stands."

On Thursday afternoon J. C. Magness, traffic director, presented his report. John S. Algeo described the accomplishments of the statistical department, including a cost system which will be used by factories representing fully 80% of the industry's production capacity. Fred J. Rummel, statistics director, estimated that container stocks amount to 6 million gross, 15% over last year's stocks, and in the course of his remarks stated that, based on the assumption of 280 operating days a year, full production capacity for glass containers reaches practically 40 million gross a year and that the present production average equals 72%, or 28 million gross.

Addresses were made on Thursday by E. G. Akerman on a standard cost system for executive control, and by T. M. Harrison on cost accounting.

S. S. Cochrane, vice-president and general manager of the Owens Bottle Company, at the Friday morning meeting presented an interesting paper on factory management which is abstracted below. I. R. Stewart read the report of the publicity committee, and J. V. Spurrier spoke on the Association's sales promotion campaign, the advertising feature of which, approved at the May meeting at Atlantic City and for which the manufacturers subscribed over $200,000, is being steadily developed.

Elliott C. McDougal of the Marine Trust Company, Buffalo, N. Y., addressed the meeting on the growth and functions of the Federal Reserve Law.

Lengthy abstracts from Mr. Cochrane's address, "Factory Management," are given below. Complete printed copies have been distributed to the members of the Association.

Mr. Cochrane's Address

(Abstracted)

My general theory of factory management can be embraced within three words—organize—deputize—supervise. It is, first of all, necessary to organize with a high measure of completeness to the end that there be a sound organization that can be moved in any direction towards any desired goal, just as a general in the field moves an army in any direction that may be necessary either for offense or defense. No one man can be everything, nor can one man do everything, hence, duties must be deputized to selected subordinates, each of whom should be carefully trained with regard to his relations to his superiors and to his associates. The general manager must supervise; he should at all times, know his men, their limitations, their good and bad points and be tactful in making use of these under all conditions. His supervision must of necessity be general, because where large numbers of men or large amounts of machinery are employed, it is not possible for him to be in all places at all times.

Plant activities that require managerial direction can be divided into three divisions—the human element—the mechanical element—the plant element.

Among the first thoughts of successful management should be the condition of the plant itself, by which I mean the buildings and all parts that are related to the building. He should always have in mind with respect to these the old rule that "A stitch in time saves nine." He should be alert and require his various assistants to be alert and detect any tendency towards deterioration of any part of the plant, and when any tendency towards deterioration is observed, it should be his first concern to see that that is immediately repaired rather than to wait until wear has progressed to a point where major repairs become necessary. Plant cleanliness should always be with him a major consideration and one that he never allows to escape him. Men are prone to allow things to go on just as they are unless some directing force compels them to make a change towards better things. There is a psychologic factor in plant cleanliness that has a dollar and cent value. Uncleanliness about a plant tends to encourage carelessness and waste. If the management is careless in this regard, the men under him will soon find themselves in a rut of carelessness which will lead on and on until definite money losses are being brought about unobserved, and then mount up until the figure becomes one that might be the difference between loss or profit in the operations. But more important still is the effect of cleanliness and tidiness about the plant, upon the people employed therein. The men are tremendously affected; they take a higher interest in their work both as to its quality and quantity, and they do this unconsciously, if all around them is an air of neatness and tidiness.

The next concern of the manager should be with regard to the power and its transmission. Direct losses not easily checked up, or a lowering of efficiency can result from some defects in the power installation. The general manager should know his power equipment; he should know all facts with relation to power transmission; he should have these carefully guarded by skilled help and should supervise it always with care and caution uppermost in his mind; he should himself, and he should encourage his subordinate to study all the newer phases of power production and its transmission to the end of bettering that which he has.

I do not think a manager should be encouraging changes simply because they are changes, but where he finds changes can be effected and the efficiency of the plant improved thereby and its costs lowered, he should not hesitate to make the recommendation. At any rate, he should know what these things are; he should know if it be true that his power production and its transmission is not the last thing obtainable, so that when the proper time comes he can make use of this knowledge.

This is an age of machine production in glass containers and the last word has not yet been said on that subject. The improvements of the last several years have been wonderful, in fact revolutionary in character, but I doubt that what has already been done is any more than a suggestion of what is to follow. It is therefore, of prime importance that the general manager be, at all times, working to the end of getting the most from that which he now has, but at the same time thinking constructively with regard to how present methods can be improved upon. "A stitch in time saves nine." By keeping his producing machines to the maximum of efficiency, he develops the man operating the machine to the same high degree of efficiency, and he should always look upon the machine as a part of the man operating it and not expect from the man results unless he makes the machine which is the other part of the man, everything that it should be.

The general manager should encourage in every reasonable way, the closest cooperation between the men who are behind the lehrs packing and sorting the ware, and the men who are at the machines. If the men at the discharge end of the lehrs, the packers and the sorters, in a friendly, constructive way, cooperate with the machine operators, improved results will undoubtedly follow.

This brings me up to a question of plant pride, a very important thing to develop. The men at the machines should have a pride in their machine—in their furnace—in their molds in their plant, in fact in everything that has to do with the making of the bottles, while the men at the discharge end of the lehrs, the packers and sorters, sould have an equal pride, all having to do with the quality and quantity of production.

In every man is an inward urge to better things—every man wants to be best; he wants to do the things he is doing better than others are doing; he wants to have the particular plant in which he works better than any other plant. The inward urge I refer to prompts him to want to have the product he turns out superior to that which any other plant turns out; the inward urge towards this is present in the men all the time, but does not of its own volition always find expression. It should be the manager's aim to develop this spirit, to encourage it in every way to the end of making the plant and its products respond to that inward urge that is in the heart of every normal man, namely, the desire to excel.

I am not a believer in standardized efficiency, that character of plant management that a few years ago was advocated by some experts, where every hand, foot or head movement was measured in inches and fractions of inches to the end of determining the energy required to perform a given task, or the distance to be traveled by hand, foot or mind to do a job. The human machine will not allow itself to be standardized. No two men are exactly alike—one may be particularly expert at one thing and another adept at another.

The manager should recognize this and learn how to best use the human element to get best results from it. He should be somewhat of a student of human nature.

A major duty of the manager should be to look after, very carefully, the storing and taking care of finished stocks. Stocks should be stored with reference to their association. Certain classes of bottles frequently move in association with others, and these should be kept as close together as the storing facilities will permit. Runways should be kept clear of debris that would retard the movement of men and trucks. General stocks should, as near as possible, be arranged so that the older stock moves out first, in fact the older goods should always have first movement into the cars even if it necessitates passing around some similar goods of more recent manufacture. I cannot stress too strongly the necessity of avoiding the concealed losses in the warehouse that are possible.

The manager should have such supervision of the stock of supplies of raw materials and of repair and renewal parts, as will insure against any shortage of needed materials at any time. This requires a high measure of care because it is quite easy to overload the factory with raw materials if their even movement into the factory is not properly arranged for and the needs of the factory properly computed.

I have heretofore, talked mainly on Factory Management in its general phase; I wish now to say a few words with specific reference to bottle factory management.

The furnace being the unit of production in each factory, should have the manager's special care. Night is a good time to look over a furnace to find where spots are beginning to wear through, because the darkness of night causes these spots to glow and stand out and by properly noting them, repairs can be made in time to prevent a too rapid disintegration at the point of weakness.

There is always in a bottle factory, an accumulation of dust and dirt on the tops of the furnaces which is in part flux, and should be frequently cleaned. Every accumulation tends to bring about overheating of the crown bricks, which causes them a shortened life. He should occasionally feel of the stay rods to see that they are tight and to note where a brick may become partially loosened in the crown or a part of the side wall, or where a block is not being properly supported or cooled.

He should from time to time, note the character of the fire in the furnace or furnaces, as a great deal depends upon whether the flame is a reducing or an oxidizing one. Furnace operators are inclined at times, to become careless with regard to the stack damper and system of measuring same and positive instructions from the manager will tend to correct this.

The lehr is a highly important part of a bottle plant equipment. They should be looked into by the manager carefully from time to time. It is of importance that a first-class pyrometer system be installed in each lehr to give a twenty-four hour record of the temperature, and these records should not only be checked carefully by the plant manager, but he should know that the heat in the lehr is properly distributed, and he can only know this by personal inspection of the lehr. A bottle 100 per cent good from a manufacturing or glass standpoint can be made 100 per cent bad by poor annealing.

He should make periodic tours around the discharge end of the lehr, noting the general character of the product as it comes forth and note, without seeming to be doing so, the various employees at that part, to see how they are taking their employment, whether in a serious or a trivial way.

It is important to keep in mind always, that one trivial minded employee in an organization can do a great deal of harm by changing the more constructive thinking of the others, and where such be found, it is necessary, in fact important, that that person be removed or brought to look upon his employment in a more serious way.

Health is a vital factor in any industry, and the manager should be careful to note any condition, whether with respect to drinking water, drainage or sewerage that might operate against the general health of the employees under his charge. Health is a factor of importance and the absence thereof a factor leading towards loss.

The mold shop is a very important part of a modern bottle factory and should receive the very active, personal attention of the general manager. The type of man at the head of the mold shop is of great importance. Correctly designed molds play a very important part in good machine operation, and it is one of the most important jobs of the manager, as poorly designed or poorly cared for molds means a failure in machine production.

The life of molds is closely associated with the mold shop and due diligence on its part in looking after mold upkeep can be made a factor of saving of very considerable importance.

The factory manager in his relations to the human element under his charge, should at all times have a maximum of consideration for them, but at the same time he must always be firm. He must never display weakness in his attitude towards them. He should be forceful and when an order is given, those affected will know that it will have to be obeyed. Constructive obedience to the orders of superiors should be the dominant rule at all times.

I have heretofore in this paper talked of the factory, its equipment and its human side, and in conclusion it might be well for me to say a word about the manager himself. The best of them are not perfection, but whatever position of prominence they may have attained, they have attained it through certain qualities. The manager should from time to time check himself up to be sure that that managerial quality that has brought him to the position he has, still exists in all its parts.

Government Publications

THE NATIONAL BUREAU OF STANDARDS has recently published a Directory of Laboratories throughout the country that are prepared to test various kinds of commodities to determine whether or not they comply with purchase specifications. This list is being issued as Bureau of Standards Miscellaneous Publication No. 90, and contains 207 commercial testing laboratories and 143 college research laboratories, arranged alphabetically in accordance with the geographical locations of the laboratories. The type of commodities tested at these various institutions is indicated by numerical references; alphabetical references indicate the nature of the test. For instance, 520 achp means that the laboratory having this symbol will make optical, chemical, thermal and physical tests on glass.

This list has been issued to encourage the specification method of buying commodities, sponsored by the Federal Specifications Board. The Bureau of Standards, according to law, makes tests and carries out investigations for other Government departments. However, it is not prepared to make tests for private individuals if other laboratories can do the work.

Purchasers not equipped to make their own acceptance tests have as a rule, been reluctant to adopt the specifications method of buying supplies and raw materials. As a result, it has happened frequently that impure, or low grade materials have been worked off on such customers. The knowledge that purchasers can at any time call upon properly qualified testing laboratories to check the deliveries made to them on contracts, based on specifications, will induce a larger number of such purchasers to take advantage of the specification method of buying. It also has the advantage that manufacturers and dealers who supply raw materials will exercise greater care in their manufacture and preparation for the market.

This publication is sold by the Superintendent of Documents, Government Printing Office, Washington, D. C. Price 15 cents.

FEDERAL AND STATE LAWS RELATING TO WEIGHTS AND MEASURES.—Miscellaneous Publication No. 20. Bureau of Standards, Department of Commerce. Third Edition. This revised compilation of the laws of states, territories, insular possessions and United States Federal Government, prepared by the National Bureau of Standards is the only publication in this field and has been critically compiled so as to present existing laws. The subject matter includes the Federal regulations for marking net quantity on food packages and state laws relating to milk and cream bottles and containers for the sale of fruits, vegetables, etc. This publication bound in buckram, 6 x 9 inches, contains 976 pages and may be obtained from the Superintendent of Documents, Government Printing Office, Washington, at $2.30 per copy, one-third of the cost to be added if shipped to a foreign country.

REPORT OF THE CENSUS taken in 1925 on Glass and Mirrors has now been issued in printed form by the Bureau of the Census, W. M. Steuart, director, and can be obtained from the Superintendent of Documents, Government Printing Office, Washington, D. C., at 5 cents a copy. Preliminary reports for these industries were issued on January 6 and 8, respectively. Advance multigraphed copies of the glass report were sent by THE GLASS INDUSTRY to all of its subscribers at that time.

The Glass World and What It Is Doing

News of the Industry

Imports and Exports, First Half of 1927

Imports of glass and glass products for the first six months of 1927, as tabulated in the monthly summary on page 230 of this issue amounted in value to $8,263,468, which was a decrease of $1,981,767 over the same period in 1926. Cylinder, crown and sheet glass showed an increase of 6,890,629 in the number of square feet imported, but a decrease of $119,065 in the value. There was a loss in the value of bent, ground, beveled, colored, painted and polished glass amounting to $94,076.

The decrease in plate glass importations amounted to 4,544,102 square feet during the first six months of 1927 as compared with the same period in 1926, and the decrease in value amounted to $1,843,551.

Imports of containers, including bottles, vials, etc., showed a decreased value of $50,024, making the total imports $98,334 for the first half of this year.

Tableware and kitchen utensils increased $21,658 to the total of $57,934 in the same period. Cut and decorated glassware showed a substantial increase amounting to $454,759, to a total of $1,641,618, while the imports of bottles, ornaments, etc., decreased from $601,469 to $408,471. Electric bulb importations decreased in quantity from 10,010,507 valued at $115,878, to 7,445,676 valued at $69,704. Chimneys, globes, shades, etc., also decreased from $524,674 in value to $429,761, and chemical scientific and experimental ware decreased from $296,262 in 1926 to $268,888. Other glassware, however showed an increase from $698,960 to $703,951.

Exports during the first six months of 1927 were very close to those of the previous year, there being a decrease of approximately $7,000 in the total. Exports of common window glass showed a decrease of approximately $33,000 in value. Plate glass unsilvered, about $6,000. Other window and plate glass, however, increased in quantity from 1,182,764 square feet to 2,400,573 feet, and in value from $115,885 to $230,296. Exports of containers (bottles, vials, jars, etc.) increased $212,838 to the total of $1,508,635. Lamp chimneys and lantern globes for the first half of 1927 showed a decrease of 104,724 pounds, the total being 1,063,553 pounds, while the value increased $2,873 to a total of $219,782. Globes and shades exported during the 6 months' period showed a small decrease in quantity and an increase in value from $279,166 to $313,243. Miscellaneous glassware showed an increase of $40,664.

First National Fuels Meeting at St. Louis

Visitors to the First National Fuels Meeting of the Fuels Division of the American Society of Mechanical Engineers, to be held in the interest of the use and conservation of fuels, October 10 to 17, will have presented to them papers and special articles on industrial power plant and smoke abatement subjects, some of the authors being of international reputation. Among the papers will be: Address on Fuels, by Prof. S. W. Parr, professor of applied chemistry, University of Illinois, Urbana, Ill.; American Fuel Resources, by O. P. Hood, chief mechanical engineer, U. S. Bureau of Mines, Washington, D. C.; Combustion and Heat Transfer, by Prof. R. T. Haslam and H. C. Hottel; The Clinkering of Coal Ash, by A. C. Fieldner, chief engineer of Experiment Stations, U. S. Bureau of Mines, Pittsburgh; Factors Governing the Purchase of Fuels, by Morgan B. Smith, engineer, General Motors Corporation; Refractories for High Temperatures, by Stewart Phelps, director of research and tests, American Refractories Institute Fellowship, Mellon Institute. Recent Developments in Low Temperature Coal Carbonization, by H. D. Savage, vice-president, Combustion Engineering Corporation; Industrial Applications of Heat, by Prof. W. Trinks, Carnegie Institute; Progress in Gas Producer Practice, by W. B. Chapman, president, Chapman Engineering Company; The Burning of Liquid Fuels, by Ernest H. Peabody, president, Peabody Engineering Corporation; The Relative Values of Gaseous, Liquid and Solid Fuels, by F. C. Binnall, Standard Sanitary Manufacturing Company; Air Preheaters, by Frank M. Van Deventer, of Henry L. Doherty Company.

Glass Distributors' Fall Meetings

The date of the fall meeting of the Eastern Division of the National Glass Distributors' Association has been changed from September 21 to 23, to September 14 to 16, to be held, as previously announced, at the Hotel Traymore, Atlantic City. On September 14 there will be a meeting and dinner for the members of the eastern executive committee only, on the 15th a general meeting of the division, presided over by S. C. Gilmore, and followed by a luncheon is scheduled. A dinner and dance will be enjoyed in the evening, while on September 16 a golf tournament will be held at the Northfield Country Club.

The Western Division will hold its fall meeting at the Congress Hotel in Chicago, September 20 and 21. A. E. Clerihew will be in charge of the general business meeting to be held on September 20, which will be followed by a theater party in the evening. On September 21 a golf tournament will be conducted.

Survey of Commercial Coal Stocks

Consumers' stocks of bituminous coal amounted to 62,000,000 tons on July 1, according to a survey just completed by the United States Bureau of Mines, Department of Commerce. In comparison with April 1, the date of the last previous survey, this was a decrease of 13,000,000 tons. In spite of the decrease, the stocks on July 1 were larger than at the corresponding season of any year on record. In comparison with last year they show an increase of 23,000,000 tons.

The consumption of bituminous coal in the second quarter of the year, including exports, averaged 9,305,000 tons a week. Production averaged 8,217,000 tons, leaving a weekly deficit of 1,088,000 tons, which was met partly out of consumers' stock piles and partly out of the very large quantity in transit in railroad cars when the suspension of mining began.

In addition there were 6,840,554 tons of bituminous coal on the docks of Lakes Superior and Michigan.

Stocks of anthracite are fully up to normal for this season of the year.

Few Changes in Flint Glass Wage Scale

The wage conference between the National Association of Manufacturers of Pressed and Blown Glass Ware and the American Flint Glass Workers' Union held at Atlantic City the latter part of July, resulted in an agreement to continue the prevailing wages in the caster place department, paste mold, pressed ware, shade, iron mold, chimney, engraving, punch tumbler, stem ware, mold making cutting departments. It was expected that slight changes in the pressed ware and chimney departments would be made later.

Requests by the workers in various departments of the trade for wage increases of from 10 to 30 per cent were offset by the manufacturers contention that a decrease of 25 per cent in the volume of business this year, due largely to foreign competition has made it difficult to grant wage increases.

Central Office for Belgian Fourcault Plants

A "Comptoir de Ventes," or Central Sales Office, was established on June 8th to control the production and sales of the sheet glass factories operating the Fourcault process in Belgium. With one exception, the Verreries de Roux, all the Belgian Fourcault factories are signatories, their names being: Verreries Bennert-Bivort, Verreries Compenoises, Verreries du Centre de Jumet, Verreries de Cronfestu, Verreries de Gilly, Verreries Hammendes, Verreries de Jemappes, Verreries de Mariemont, Verreries Mecanique de Charleroi et Dampremy Zeebrugge.

Offices are being opened in Brussels, the present commercial manager of the Verreries Mecanique de Charleroi, M. Dessausoie, having been appointed director of the Comptoir, which has the approval of the workers' union interested.

Ohio State University Announces Ceramic Course

A four year course leading to the degree of Bachelor of Ceramic Arts is announced by the Ohio State University, Columbus, O. The object is to train men to serve in the clay, glass and glass enamel ware plants as creative ceramists by equipping them with knowledge of materials, mixtures, and processes used in ceramic ware production; with the fundamental art concepts of ensemble possibilities of shape, quality, color, and decoration, and with appreciation of the service which particular clay and glasswares should give. Details of the course are given in the University Bulletin of August 15.

Glass Men Leave for Russia

A party of glass men from the Pittsburgh district sailed on the Hamburg-American liner "New York," on August 24, for Germany. They will proceed immediately to Moscow where they will be employed in the Steklostroy glass factory near that city. This plant was built by the Simplex Engineering Company about a year and a half ago and it is understood that it contains 21 Lynch machines and that orders are pending for additional machines to be shipped later. The party is composed of Mark Stanger, William Ward, Jacob Reid and Charles Hentzy.

Wage Increase for Bottle Blowers.

After conferences at Atlantic City with the Glass Bottle Blowers Association, the bottle manufacturers agreed upon a wage increase of from 10 to 25 per cent. The workers had been demanding an increase of 20 per cent which was offset by the manufacturers' request for a reduction of the same amount. The new agreement took effect September 1. This was the only change made in the wage scale. Charles B. Garwood of Carr-Lowrey Glass Company presided at the joint conference.

Stained Glass Association Elects Officers

At the last annual meeting of the association held in St. Louis, Mo., the following officers were elected: F. P. Oppliger, president; Paul G. Kase, first vice-president; C. P. Friederichs, second vice-president; Melvin B. Neff, treasurer; Roy J. Vogel, secretary. The members of the executive committee are: Henry Hunt, Pittsburgh, Pa., Otto W. Heinigke, New York, George Leslie Payne, Paterson, N. J., Leo Howe, Detroit, Mich., George F. Mueller, Milwaukee, Wis.

Must Pay Royalties

After litigation lasting seven years, Charles E. Blue, who sued the Hazel-Atlas Glass Company for royalties on products manufactured by the company on machines which he claims to have invented and turned over to the company, a decision was given on August 8, by Judge J. B. Summerville, of the Ohio County, W. Va., circuit court, in favor of Mr. Blue.

Eleventh Annual Chemical Exposition

When the doors open on the coming Eleventh Exposition of Chemical Industries at the Grand Central Palace, New York, there will be between 350 and 400 exhibits, a substantial percentage of them of interest to the glass trade. The fall meeting of the American Ceramic Society will be held during the exposition, on Thursday, September 29th.

Swindell Brothers Arrange for Hartford-Empire License

The Hartford-Empire Company, Hartford, Conn., have granted a license to Swindell Brothers, Baltimore, Md., to operate certain Bethel feeders which were installed at that plant during the summer of 1926.

Glass Container Fall Meeting

The Glass Container Association will hold its fall meeting at the Fort Pitt Hotel, Pittsburgh, on Thursday and Friday, October 27 and 28. No definite program has been arranged.

The financial report of the American Flint Glass Workers Union presented at the annual convention of the association at Cambridge, O., showed a gain in resources of $14,728 during the fiscal year and a net balance on May 31 of $695,388.

July Plate Glass Production

The production of polished plate glass for the month of July, 1927, as compiled by P. A. Hughes, secretary of the Plate Glass Manufacturers of America, was 8,868,425 square feet, as compared with 7,998,708 square feet, produced during the month of June, or an increase of about 11 per cent. The total production for the seven months ending July 31, 1927, amounts to 67.099,515 square feet.

Glass Companies' Financial Reports

The report of the **Hazel-Atlas Glass Company** for the second quarter of 1927 showed an operating profit of $1,601,224, a gain of $168,497 over the corresponding period of 1926, while maintenance and repairs of $210,445 are $18,613 higher. Net operating income was $1,390,779, compared with $1,240,895 for the same period last year, an increase of $149,884, or 12 per cent. Reserves for depreciation, taxes, reserves, etc., continue to show an increase, amounting to $636,495, a gain of $76,382. Interest charges increased $14,841 to $28,661. Net income applicable to the stock was $725,623, equivalent to $1.88 a share on the 386,978 shares (par $25) now outstanding, compared with $666,962, or $1.43 a share, on 463,832 shares outstanding in the same period of last year.

Net income for the first six months of the year was $1,195,-208, equivalent to $3.09 a share on the stock now outstanding, compared with $1,119,593, or $2.41 a share, on the stock outstanding in the corresponding period of last year.

The report of **Owens Bottle Company** and subsidiaries for six months ended June 30, 1927, shows net profit of $2,792,023 after expenses and federal taxes, equivalent after 7% preferred dividend requirements, to $3.64 a share (par $25) earned on 728,853 shares of common stock. This compares with $3,446,-552, or $4.55 a share, on 693,890 shares outstanding in first six months of 1926.

Net profit for the quarter ended June 30, last, was $1,672,-905 after above charges, equal to $2.22 a share on 728,853 common shares, comparing with $1,119,117, or $1.34 a share on 729,906 shares in preceding quarter and $2,232,139, or $3.01 a share, on 693,890 shares of common in second quarter of previous year.

The report of **Standard Plate Glass Company** for quarter ended June 30, 1927, shows net loss of $50,542 after interest, depreciation, etc., comparing with net loss of $192,400 in preceding quarter, and net profit of $126,433, equal to 3 cents a share on common stock, after allowing for 7% prior preference and 7% preferred stocks in second quarter of 1926.

Net loss for first six months of 1927, was $242,942 after above charges, against net profit of $154,034 equal to $1.75 a share on 49,914 shares of 7% preferred stock, after allowing for 7% prior preference dividends in first half of previous year.

Trade Activities

A tank at the plant of the **Acme Glass Company,** Olean, N. Y., burst on August 14 with some damage to the glass working machinery.

The Graham Glass Company, Evansville, Ind., has awarded the contract to the Rust Engineering Company, Pittsburgh, Pa., for a new plant, 160 by 254 feet.

The offices of the **National Window Glass Workers** have has moved from 712 Park Building, Cleveland, O., to 300-3 Gugle Building, 174 East Long Street, Columbus, O.

The Harbison-Walker Refractories Company, Pittsburgh, Pa., are planning the erection of a large plant at Baltimore, Md., in which high grade fire brick will be manufactured.

The Corhart Refractories Company has let the contract for the construction of the first unit of its plant at 16th and Lee Streets, Louisville, Ky., to a local contractor, L. W. Hancock, and actual building operations are under way.

The Citizens' Glass Corporation has received authorization from the Ohio State Securities commission to proceed with the sale of the stock of the company, and is also given permission to operate in the State of Ohio, the company having been incorporated in the State of Delaware.

The Libbey-Owens Sheet Glass Company has let contract for a $2,000,000 addition to its plant at Toledo, O., to be used for housing grinding equipment. Plans were prepared by the Detroit, Mich., office of Lockwood, Greene & Company, architects.

Berkeley Glass Sand Company, Berkeley Springs, W. Va., has been organized with a capital of $5,000 by Addison E. Mullikin, F. Stanley Porter, R. C. Willis, Jr., Theodore C. Waters and A. J. Hundertmark, all of Baltimore, Md.

W. C. Tibby, of the **Tibby-Brawner Glass Company,** Punxsutawney, Pa., recently announced that he had purchased the entire holdings of the company, and that the plant would be continued under his direction as sole owner.

The Gray Glass Corporation, Dubois, Pa. has filed an application for a Pennsylvania state charter. The character and object of this corporation is "to buy and sell at wholesale and retail and manufacture glass and glass products of all kinds, character and description."

The Standard Plate Glass Company, Pittsburgh, Pa., have had plans prepared by Hunting, Davis & Dunnells, Century Building, for a new four-story and basement building, 40 by 154 feet, to be erected on Galveston Avenue, Northside, Pittsburgh.

The Hazel-Atlas Glass Company's plants at Clarksburg and Grafton, W. Va., and to some extent their other plants, recently experienced a strike of mold makers, resulting from an effort on the part of the American Flint Glass Workers' Union to unionize the mold shops. Company officials reported that production operations had not been seriously affected.

The Vitaglass Corporation, New York, has authorized a $500,000 stock issue making the total capitalization of the company $600,000. The plan, subject to the approval of the stockholders, includes the issuing of two shares of no par value with each share of 7 per cent cumulative preferred. The company controls the sole rights for the sale of Vitaglass, the new ultra-violet product, throughout North America.

L. Solomon & Son, 199 Wooster street, New York, prominent importers and dealers in flat glass and specialties in plate glass and originally established in a small way 39 years ago, have incorporated with a capital stock of $1,000,000 and a surplus of $500,000. No change whatever will be made in the personnel or the management of the concern. The incorporators are: Abraham Solomon, who has been in control of the business since 1924; Mrs. A. Solomon and L. Roth, attorney.

The Brilliant Glass Products Corporation, an outgrowth of the Brilliant Glass Products Company of Brilliant, O., has begun the construction of a plant at Edmiston, near Weston, W. Va., and on the Weston-Clarksburg interurban line. The contract is reported to call for a building 80 by 150 feet in size. The site is said to have been given free to the company. The officers of the new company are: Charles M. Snaith, president; J. W. Farnsworth and R. H. Pritchard, vice-presidents; Frank K. Shaffer, secretary, and W. A. Edwards, treasurer.

The Corning Glass Works, according to information given out by W. H. Curtiss, assistant to President Alexander D. Falck, is rebuilding tank No. 1 at the company's Wellsboro, Pa., plant. It is expected that the new tank will be completed November 1 and that an automatic bulb machine, similar to the one already in use on No. 2 tank, in the same plant, will be installed. The new tank is of different design than the old one and will be largely used for experimental purposes. Repairs on tank No. 2 were recently made and it was planned to resume operations late in August. After November 1, the two tanks, it is said will be operated alternately.

Changes brought about by the rapid growth in the business of the **Illinois-Pacific Glass Company,** San Francisco, Cal., were effected at a meeting of the board of directors on August 1, when Max M. Cohn of San Francisco, a member of the board for several years, was made chairman and his business partner, William H. French, was made vice-president. Kenneth M. Henry, inventor of the revolutionary electric lehr used by the company, a description of which was first put before the glass trade in our August, 1925, issue, was elected a director. He will represent the board at the new Los Angeles plant now under construction.

The General Flat Glass Company, which last year began the reconstruction of the old Mannington Glass Company factory at Mannington, W. Va., now have it almost completed and operations are expected to be started about the middle of September. The business is capitalized at $300,000. It is reported that the cost of remodeling was approximately $165,000 and that the present valuation of the plant is estimated at $350,000. The plant is equipped with sheet glass drawing machines designed on the Fourcault principle. There are six of these machines giving the factory a large production capacity. It is said that about 200 workmen will eventually be employed. The officers of the company are: H. D. Atha, president; Jo L. Keener, 1st vice-president; H. E. De Vaughn, 2nd vice-president; Charles W. Prichard, secretary; Chester L. Prichard, treasurer and Roy F. Alder, general manager.

Personals

George W. Aiken, until recently with the Monongah Glass Company, Fairmont, W. Va., is now connected with the H. J. Heinz Company, Sharpsburg, Pa.

George St. J. Perrott, of North Dakota has been appointed superintendent of the Pittsburgh Experiment Station of the United States Bureau of Mines, Pittsburgh, Pa., to succeed Arno C. Fieldner, who has been promoted to the post of chief engineer, Division of Experiment Stations.

C. W. Chatham, for many years in charge of the Pittsburgh district office of the Eagle-Picher Lead Company, announces his appointment as manager of the Pittsburgh district for the Metals Refining Company, Hammond, Ind., manufacturers of oxides for the glass and enameling industries. Mr. Chatham's many friends will wish him complete success in his new venture.

Robert J. Piersol, 3617 Dawson street, Pittsburgh, Pa., formerly research engineer for the Westinghouse Electric & Manufacturing Company, has changed to consulting engineering, specializing on the installation and operation of chromium plating. Special emphasis will be placed on the advantages of chromium plating for glass molds and for rolls in the plate glass industry.

Recent Deaths

Caesar A. Grasselli

Caesar A. Grasselli, chairman of the board of directors of the Grasselli Chemical Company, died in Cleveland, O., on July 27 at the age of 77. Mr. Grasselli's father founded the company in 1839.

Harry W. Seitz

Harry W. Seitz, vice-president and treasurer of the American Bottle Company, Toledo, O., died on July 21, at the age of 52. Mr. Seitz was at one time connected with the Edward H. Everett Company of Newark, O., which later was taken over by the Ohio Bottle Company, and in 1904 became sales representative for that concern until it was acquired by the American Bottle Company in 1905, when he was made assistant superintendent of the Newark, O., plant. He was connected later with the general offices of the company at Chicago and when they were moved to Toledo he was appointed vice-president and treasurer of the company.

Coming Meetings

AMERICAN REFRACTORIES INSTITUTE will hold its fall meeting at the Hotel Clifton, Niagara Falls, Canada, on September 15.

THE AMERICAN CERAMIC SOCIETY annual meeting will be held at the Ambassador Hotel, Atlantic City, N. J., February 5, 1928. Fall meeting will be held during Chemical Industries Exposition at Grand Central Palace, New York, on Thursday, September 29. European tour of Society will cover a period of six weeks beginning May 19, 1928, and will include visits to England, Germany, Czechoslovakia, France, Holland.

THE ELEVENTH EXPOSITION OF CHEMICAL INDUSTRIES will be held in the Grand Central Palace, New York, September 26 to October 1, 1927.

EASTERN DIVISION OF NATIONAL GLASS DISTRIBUTORS ASS'N.

has changed the date of its meeting to be held at the Hotel Traymore, Atlantic City, N. J., from September 21 to 23, as previously fixed, to September 14 to 16, inclusive. The WESTERN DIVISION will hold its fall meeting at the Congress Hotel, Chicago, Ill., September 20 and 21.

THE MIRROR MANUFACTURERS ASSOCIATION will hold its next meeting at the Congress Hotel, Chicago, Ill., on September 22.

THE FIRST NATIONAL FUELS MEETING of the Fuels Division of the American Society of Mechanical Engineers will be held in St. Louis, Mo., October 10 to 13 inclusive.

THE GLASS CONTAINER ASSOCIATION will hold its fall meeting at the Fort Pitt Hotel, Pittsburgh, Pa., October 27 and 28.

Inquiries Received

382. We would like the names of firms manufacturing transparent door knobs, also high class colored glass lamp vases and other ornamental glass or pottery items that are used for decorative purposes. (July 25).

383. What concerns are equipped to manufacture glass letter boxes? (August 1).

384. Where can we purchase glass vacuum bottles?

385. (From Germany). Can you put me in touch with manufacturers of automatic machines for making vials, etc., from glass tubing. (August 6).

386. Can you put us in touch with a glass blower capable of blowing chemical glass ware of high precision for research work? (August 12).

387. We are desirous of getting in touch with firms that can make a glass specialty, viz: combination beater and fruit extractor, at a low price and in quantities. We to furnish mold. (August 17).

What the World Wants

Specific Inquiries for American Goods, Received in the Department of Commerce, Washington, D. C.

Germany: 26579, glass-blooming machines for production of tubes, pipes, bottles.

Portuguese East Africa: 26665, cheap glassware.
Italy: 26781, incandescent lamp glass.
Australia: 26786, domestic and fancy lighting glassware.
Brazil: 26882, window glass.
Mexico: 26976, glassware.
Chile: 26944, glassware.

Glass Stock Quotations

PITTSBURGH STOCK EXCHANGE, AUGUST 22, 1927.

Reported by Moore, Leonard & Lynch, Union Trust Building, Pittsburgh, Pa.

	Bid	Asked	Last
American Window Glass Machine, com....	36	40	35⅛
American Window Glass Machine, pfd.....	..	..	70
American Window Glass, pfd.....	..	..	106½
United States Glass.....	..	13½	13
Pittsburgh Plate Glass, com.....	232	232	231
Standard Plate Glass, com.....	..	..	3¼
Standard Plate Glass:			
Preferred cumulative	10½	12	11⅝
Prior preferred	..	..	33

TOLEDO STOCK EXCHANGE, AUG. 22, 1927

	Bid	Asked	Last
Owens Bottle Machine, com.....	115⅛	117¼	117¼
Libbey-Owens Sheet Glass, com.....	128	130	128¼
Libbey-Owens Sheet Glass, pfd.....	115	...	115

WHEELING STOCK EXCHANGE.

	Bid	Asked	Last
Hazel-Atlas	..	..	63½
Imperial	..	..	72
Fostoria	..	..	208
Central	..	..	75

READERS WANTS AND OFFERS

Manufacturing Plant in Middle Atlantic States requires immediately a man to take complete charge of Stock Department. One experienced with modern plate glass or marble stock room equipment and routine essential. Must be systematizer and able to handle men. Reply stating age, nationality, qualifications, and salary expected. All applications will be treated confidential. Address: Stock Room, c/o THE GLASS INDUSTRY, 50 Church St., New York.

Salesman Wanted—High grade, experienced salesman with wide acquaintance and familiar with the bottle trade, to sell bottles to manufacturing consumers. The man we want is now employed in a responsible position with some glass house at a good salary, but who has limited opportunities. Give age, experience, reference, salary expected. Correspondence confidential. Address Glass, care THE GLASS INDUSTRY, 50 Church Street, New York.

For Sale: CULLET of all Descriptions
Free from Caps, Wires, etc.
GEORGE F. BAUMANN, Dealer.
1110 Carroll Street, Brooklyn, New York.
Carloads Ready for Immediate Shipment.

For Sale: Journal of the Society of Glass Technology. December, 1919; March and December, 1923. Complete sets of 1920, 1921 and 1922. Price (unbound) $22.00. Address Box P, care THE GLASS INDUSTRY, 50 Church Street, New York.

STAINED GLASS

First class expert, German, who will emigrate to America very soon desires a position or connection with a reliable firm. Write to W. Reitze, I. Kostverl. Kade 12 II, Amsterdam, Holland.

Current Prices of Glass-Making Materials

August 22, 1927

Quotations furnished by various producers, manufacturers and dealers.

		Carlots	Less Carlots
Acid			
Citric (dom.)	lb.	.44½	.44½
Hydrochloric (HCl) 20° tanks, per 100	lb.	..	1.05-1.10
Hydrofluoric (HF) 60% (lead carboy)	lb.	..	.13½
52% and 48%	lb.	.10	.10-.11½
Nitric (HNO_3) 38° carboy ext. Per 100	lb.	5.50	5.75
Sulphuric (H_2SO_4) 66° tank cars	ton	15.00-16.00	..
Tartaric	lb.	.37	.37
Alcohol, denatured	gal.	..	.43
Aluminum hydrate ($Al(OH)_3$)	lb.	.04½-.05	.05-.05½
Aluminum oxide (Al_2O_3)	lb.	..	.07
Ammonium bifluoride (NH_4) FHF	lb.	..	.19-.21
Ammonia water (NH_4OH) 26° drums	lb.	..	.03¼
Antimony, metallic (Sb)	lb.	..	.11½
Antimony oxide (Sb_2O_3)	lb.	..	.15½-.16
Antimony sulphide (Sb_2S_3)	lb.	.15	.16
Arsenic trioxide (As_2O_3) (dense white), 99%	lb.	.04	.04¼-.04½
Barium carbonate ($BaCO_3$)			
Precipitated	ton	53.00	58.00
Natural, powdered, imported	ton	48.00	50.00
Barium hydrate ($Ba(OH)_2$)	lb.	..	..
Barium nitrate ($Ba(NO_3)_2$)	lb.	.08¼	.08½
Barium selenite ($BaSeO_3$)	lb.	..	..
Bone ash	lb.	.05	.05½
Borax ($Na_2B_4O_7 10H_2O$)	lb.	.04	.04¼-.04¾
Boric acid (H_3BO_3)	lb.	..	.08¼-.08½
Refined	lb.	.08-.08¼	.08½-.08¾
Cadmium sulphide (CdS)—			
Red	lb.	..	1.20
Orange	lb.	..	1.10-1.25
Yellow	lb.	..	1.20-1.40
Chromium oxide (Cr_2O_3)	lb.	.27	.28
Cobalt oxide (Co_2O_3)			
In bbls.	lb.	..	2.10
In 10 lb. tins	lb.	..	2.20
Copper oxide			
Red (Cu_2O)	lb.	..	.30
Black (CuO)	lb.	..	.25-.30
Black prepared	lb.	.	.30
Cryolite ($Na_3Al F_6$) Natural Greenland			
Kryolith)	lb.	..	.09⅛-.09½
Artificial or Chemical	lb	..	.09½
Epsom salts ($MgSO_4$) (imported) Per 100	lb.	..	1.15-1.30
Feldspar—			
100 mesh	ton	11.00-20.00	15.50-22.00
80 mesh	ton	..	14.50
40 mesh	ton	12.50	13.50
Fluorspar (CaF_2) domestic, ground, 95-98% (max SiO_2 2½%)			
Bulk, carloads, f.o.b. mines	ton	32.50	..
In bags or barrels	ton	36.50	41.50
Formaldehyde	lb.	.09½	.10
Graphite (C)	lb.	..	.04-.07
Iron oxide—			
Red (Fe_2O_3)	lb.	..	.02-.03½
Black (FeO)	lb.	..	..
Kaolin (f.o.b. mine)	ton	10.00	..
English, lump, f.o.b. New York	ton	13.00-23.00	..
Kryolith (see Cryolite)			
Lead chromate ($PbCrO_4$)	lb.	..	..
Lead oxide (Pb_3O_4) (red lead)	lb.	.10	.10¼
Litharge (PbO)	lb.	.09	.09¼
Lime—			
Hydrated ($Ca(OH)_2$) (in paper sacks)	ton	12.50	..
Burnt (CaO) ground, in bulk	ton	9.00	..
Burnt, ground, in paper sacks	ton	11.00	..
Burnt, ground, in 280 lb. bbls.	Per bbl.	2.15	2.30
Limestone ($CaCO_3$)		2.00	..
Magnesia (MgO)—			
Calcined, heavy (in bbls.)	lb.	.05-.06	.07
light (in bbls.)	lb.	..	.23
extra light (in bbls.)	lb.	..	.37
Magnesium carbonate ($MgCO_3$)	lb.	.06	.07½-.08
Manganese 85% (MnO_2)	lb.	.04½	.05
Nickel oxide (Ni_2O_3), black— for nickel content	lb.	..	.35
Nickel monoxide (NiO), green— for nickel content	lb.	..	.35
Plaster of Paris, bags	ton	..	23.00
Potassium bichromate ($K_2Cr_2O_7$)—			
Crystals	lb.	.08¼	.08⅝
Ground	lb.	.11	.12
Potassium carbonate—			
Calcined (K_2CO_3) 96-98%	lb.	.06⅝	.07⅛
Hydrated 80-85%	lb.	.06	.06½
Potassium chromate (K_2CrO_4)	lb.	..	.27
Potassium hydrate (KOH) (caustic potash)	lb.	.07½	.08
Potassium nitrate (KNO_3) (gran.)	lb.	..	.05⅞-.06
Potassium permanganate ($KMnO_4$)	lb.	.14½	.15
Powdered blue	lb.	..	.24-.26
Rochelle salts, bbls.	lb.	..	.23
Rouge	lb.	..	..
Rutile (TiO_2) powdered, 95%	lb.	.15-.20	.20-.25
Salt cake, glassmakers (Na_2SO_4)	ton	22.00	..
Selenium (Se)	lb.	..	2.10-2.15
Silver nitrate ($AgNO_3$)	oz.	..	.40⅛
Soda ash (Na_2CO_3) dense, 58%—			
Bulk, on contract	Flat per 100 lb.	1.22½-1.27½	..
In barrels	Per 100 lb.	1.55-1.57½	2.40
In bags	Per 100 lb.	1.37½	..
Spot orders	.05 per 100 lbs. higher		
Sodium bichromate ($Na_2Cr_2O_7$)	lb.	.06¼	.06¾
Sodium hydrate (NaOH) (caustic soda)	Per 100 lb.	..	3.50
Sodium nitrate ($NaNO_3$)—			
Refined (gran.) in bbls.	lb.	.03¾	.04
95 per cent	Per 100 lb.	2.30	2.75
Sodium selenite (Na_2SeO_3)	lb.	..	2.35
Sodium fluosilicate (Na_2SiF_6)	lb.	.04½	.05
Sodium uranate (Na_2UO_4) Yellow or Orange	lb.	..	1.25
Sulphur (S)—			
Flowers, in bbls.	Per 100 lb.	3.45	3.80-4.00
Flowers, in bags	Per 100 lb.	3.10	3.45-3.65
Flour, heavy in bbls.	Per 100 lb.	2.85	3.20-3.40
Tin chloride ($SnCl_2$) (crystals)	lb.	.44½	.45
Tin oxide (SnO_2) in bbls.	lb.	.67	.70
Uranium oxide (UO_2) (black, 96% U_3O_8) 100 lb. lots	lb.	..	1.25-2.25
Zinc oxide (ZnO)	lb.	.06½	.07
Zircon			
Granular (Milled .005-.02c higher)		.07	.07½-.08
Crude, Gran. (Milled .005-.02c higher)		.03½	.04-.05

Monthly Summary of United States Foreign Commerce in Glass

EXPORTS

Corrected to July 25, 1927

	June 1926 Quantity	June 1926 Value	June 1927 Quantity	June 1927 Value	Six Months Ending June 1926 Quantity	Six Months Ending June 1926 Value	Six Months Ending June 1927 Quantity	Six Months Ending June 1927 Value
Glass and glass products (total)	.....	$772,641	.....	$802,925	.....	$4,435,619	.....	$4,428,866
Plate and window glass—								
Window glass, common, box 50 sq. ft.	1,380	9,213	2,120	13,236	17,433	96,403	10,320	63,368
Plate glass, unsilvered, sq. ft.	89,893	23,650	58,395	24,789	686,639	166,147	507,254	160,325
Other window and plate glass lbs.	268,860	22,500	501,050	46,138	1,182,764	115,585	2,400,573	230,296
Glass containers (bottles, vials and jars)	.....	257,728	.....	313,391	.....	1,395,797	.....	1,508,635
Table glassware, plain	.....	144,644	.....	118,314	.....	817,877	.....	748,507
Table and other glassware, cut or engraved	.....	13,280	.....	10,330	.....	93,963	.....	69,262
Lamp chimneys and lantern globes lbs.	180,092	32,992	181,888	33,487	1,168,277	216,909	1,063,553	219,782
Globes and shades for lighting fixtures lbs.	161,253	48,413	169 073	55,594	879,162	279,166	854,122	313,243
Chemical glassware lbs.	14,319	14,176	17,759	20,397	109,269	100,539	87,711	86,168
Electrical glassware, except for lighting lbs.	831,526	60,063	214,715	16,929	3,235,851	278,562	1,200,747	113,945
Other glassware	.....	145,982	.....	150,320	.....	874,671	.....	915,335

IMPORTS

Corrected to July 25, 1927

Glass and glass products	.....	1,854,233	.....	1,376,261	.....	10,245,235	.....	8,263,468
Cylinder, crown and sheet—								
Unpolished dut. lb.	8,695,232	329,507	.....	.....	39,981,754	1,749,975	.....	.....
Weighing less than 80 pounds per case dut. lb.	.....	.....	2,646,356	78,775	.....	.....	24,546,670	641,163
Weighing 80 pounds or over per case dut. lb.	.....	.....	4,421,559	179,392	.....	.....	22,325,713	989,747
Bent, ground, beveled, colored, painted, etc., and polished dut.	.....	45,162	.....	37,825	.....	299,050	.....	204,974
Plate glass dut. sq. ft.	2,206,955	762,575	.....	.....	13,974,050	4,592,474	.....	.....
Polished, unsilvered dut. sq. ft.	.....	.....	1,514,591	390,046	.....	.....	8,831,111	2,605,610
Other plate glass dut. sq. ft.	.....	.....	120.549	21.692	.....	.....	598,837	143,313
Containers—bottles, vials, etc dut.	.....	20 037	.....	15,692	.....	148,358	.....	98,334
Table and kitchen utensils dut.	.....	6.355	.....	9.942	.....	36.276	.....	57,934
Glassware, cut or decorated dut.	.....	242,561	.....	285,914	.....	1,186,859	.....	1,641,618
Blown glassware, n. e. s.—								
Bottles, ornaments, etc dut.	.....	175.250	.....	102 066	.....	601,469	.....	408,471
Bulbs for electric lamps dut.	1,579,119	17,264	1,077,041	10.802	10,010,507	115,878	7,445,676	69,704
Chimneys, globes, shades, etc dut. No.	.....	88,699	.....	70,174	.....	524,674	.....	429,761
Articles and utensils for chemical, scientific, and experimental purposes dut.	.....	57.318	.....	51,134	.....	291 262	.....	268,888
Other glassware dut.	.....	99,505	.....	122,807	.....	698,960	.....	703,951